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Great Sand Dunes National Park and Preserve
Colorado



Draft Great Sand Dunes National Park and Preserve Ungulate Management Plan and Environmental Impact Statement

April 2018



DRAFT
UNGULATE MANAGEMENT PLAN AND ENVIRONMENTAL IMPACT STATEMENT
GREAT SAND DUNES NATIONAL PARK AND PRESERVE
Alamosa and Saguache Counties, Colorado
April 2018

Lead Agency: National Park Service (NPS)

Cooperating Agencies: Colorado Parks and Wildlife (CPW); U.S. Fish and Wildlife Service (USFWS)

The combined General Management Plan (GMP) / Wilderness Study for the Great Sand Dunes National Park and Preserve (GRSA) was approved in 2007. The GMP concluded that the NPS should develop an elk management plan to address concerns of elk concentrations in GRSA. Currently there is an overconcentration of elk in the park and the wintering elk population on NPS lands is much higher than that which occurs on adjacent winter ranges. The GMP also addressed the potential future acquisition of the Medano Ranch from The Nature Conservancy (TNC) where TNC currently manages a bison herd, concluding that if additional bison habitat became available at some time in the future, the NPS could consider managing bison in the park.

As a result of the guidance in the GMP and the pending acquisition of the Medano Ranch, the NPS has prepared this Ungulate Management Plan / Environmental Impact Statement (UMP/EIS) to determine the appropriate future management of elk and bison in GRSA. This document provides background information about conditions in and around GRSA. It analyzes, in detail, environmental impacts on wetland vegetation communities, elk and bison, wilderness character, archeological resources, and socioeconomics (game damage) that would be expected from implementing each of the four alternatives for elk and bison management, including the no action alternative (i.e., continuation of current management practices).

The review period for this document will end 45 days after publication of the U.S. Environmental Protection Agency Notice of Availability in the Federal Register. During the comment period, comments will be accepted electronically through the NPS Planning, Environment, and Public comment website at <http://parkplanning.nps.gov/grsa> and in hard copy delivered by the U.S. Postal Service or other mail delivery service or by hand to the address below. Comments will not be accepted by fax, email, or in any other way than those specified above. Bulk comments in any format (hard copy or electronic) submitted on behalf of others will not be accepted. Before including your address, telephone number, electronic mail address, or other personal identifying information in your comments, you should be aware that your entire comment (including your personal identifying information) may be made publically available at any time. While you can ask us in your comments to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

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Summary



Summary

Purpose of the Plan

The purpose of this Ungulate Management Plan / Environmental Impact Statement (UMP/EIS) is to determine the appropriate future management of elk and bison in Great Sand Dunes National Park and Preserve (GRSA¹) that supports long-term protection of resources and is compatible with conditions and management activities across the broader eastern San Luis Valley landscape, to the extent practicable.

Need for Action

This planning effort is needed because of the following:

- Elk and bison are currently on the landscape and there is no plan to address their management and impacts, both positive and negative, in support of desired habitat conditions.
- Disproportionate elk use in sensitive and highly productive/diverse areas of the Park are leading to adverse impacts, particularly in wetland vegetation communities. In addition, the existing bison herd spends a disproportionate amount of time using these same vegetation communities, particularly during winter when elk overconcentration is the highest.
- Bison are currently managed by The Nature Conservancy (TNC) on the Medano Ranch and portions of the Park and a decision is needed to determine whether to have bison at GRSA in the future and if so, how to manage them.
- The Department of the Interior Bison Conservation Initiative (DOI 2008) and the National Park Service (NPS) Call to Action (Back Home on the Range), combined with additional information about bison and bison habitat in the San Luis Valley, provides an opportunity to reexamine the potential for bison conservation.

Objectives in Taking Action

The following management objectives were identified relative to elk and bison management at GRSA.

Elk and Bison

- Identify effective management tools and develop a framework to guide how and when they would be used.
- Support the attainment of desired habitat conditions as specified in this plan.
- Enhance agency understanding of ungulate habitat selection and the influence of ungulate herbivory.

¹ Hereafter referred to as GRSA when referring to the park and preserve, Park when referring only to the Park, and Preserve, when referring only to the Preserve.

Visitor Experience

- Enhance public awareness and understanding of the ecological role of elk and bison on the landscape.

Park Management and Operations

- Develop and implement an adaptive management program to increase understanding of ungulate-habitat relationships and incorporate that information into future management.

Scope of the Environmental Impact Statement

Through the course of developing this EIS, the NPS has continued to evaluate what decisions can be made at this time related to managing elk and bison at GRSA. This evaluation has been informed by past and ongoing efforts to understand the relative contributions of elk and bison to impacts on sensitive wetland environments at GRSA. Current evidence suggests that the effects of elk on wetland vegetation communities are a result of disproportionate use of these sensitive habitats (as opposed to overall population abundance). The above factors along with evolving views on bison conservation, and the potential for the NPS to acquire the Medano Ranch from TNC, as envisioned in the General Management Plan (GMP) for GRSA, defined the scope of this EIS.

The NPS is able to analyze the environmental impacts of elk management tools in detail in this EIS because there is specific information regarding the use of these tools and their potential effects. However, for bison, potential management tools under Alternatives 3 and 4 and their environmental impacts are analyzed programmatically in this EIS (addressing general environmental issues only). This is because NPS management actions are not expected to occur for approximately 5 to 7 years under Alternatives 3 and 4, and other management needs associated with NPS acquisition of the Medano Ranch could influence how the NPS implements such actions. As such, the specifics of bison management actions and their potential effects are unknown at this time.

As a result, the NPS is preparing this EIS to analyze specific proposals related to elk management tools that might be used to address overconcentration issues; and to provide a broader, higher level analysis of potential decisions about the future of bison in GRSA, such as 1) whether or not to amend the GMP to allow for bison at GRSA, and if so, how many bison might be appropriate; 2) when the NPS would assume bison management responsibilities; and 3) what management tools the NPS might use upon assuming bison management responsibilities. This higher level analysis is described as “programmatic,” and is intended to address the general environmental issues, impacts, and benefits relating to these broad decisions about bison. While the NPS feels this a meaningful point to make these broad decisions, there is too much uncertainty at this time regarding when and how potential bison management tools would actually be implemented should the NPS select an alternative that includes bison at GRSA. If such an alternative becomes the selected action, this programmatic National Environmental Policy Act review for bison would support planning-level decisions and provide a body of information that can be incorporated by reference into future planning/compliance that may be needed.

Alternatives Considered

The alternatives considered include a “no-action” alternative plus three “action” alternatives—including the preferred alternative—that were developed by an interdisciplinary NPS team that considered input from a science team convened for this plan, cooperating agencies, and the public during the planning process. The three action alternatives were considered reasonable in that they meet the purpose and need and are technically feasible.

Alternative 1 (No Action) — Existing management would continue under Alternative 1 (no-action) according to the 2007 GMP Record of Decision. Under this alternative, there would be no active elk management and no new action would occur to manage impacts from elk, including the effects of elk herbivory. TNC would continue to graze bison on the Medano Ranch until government acquisition and would be responsible for removing their bison and associated fencing prior to NPS acquisition of the Medano Ranch. The NPS would remove the current bison fencing on NPS lands.

Alternative 2 — Alternative 2 would incorporate active elk management to redistribute elk from areas of overconcentration. Active elk management actions would occur in the Park, not the Preserve, and would include non-lethal elk dispersal tools, such as hazing, and lethal removal for dispersal. Additional exclosures (fencing) would be constructed for the purpose of protecting sensitive habitat or for habitat restoration. This alternative would follow the current direction in the GMP for bison, as described for Alternative 1.

Alternative 3 (Preferred Alternative) — Alternative 3 would include the same non-lethal and lethal management elk redistribution tools and management actions as Alternative 2. Under this alternative, the NPS would make a programmatic decision to amend the GMP and manage a bison herd in the Park after acquisition of the Medano Ranch. For the first 5–7 years after acquisition of the Medano Ranch, the NPS would seek to partner with TNC to manage the bison herd. The details of this partnership would be worked out via the land acquisition process. Over time, the bison herd would be managed within a density range of 0.001 and 0.01 bison per acre. After 5–7 years following NPS acquisition of the Medano Ranch, the NPS would assume responsibility of bison management. Bison would initially be managed on NPS land within the existing bison fence, yet the bison range could be expanded within the life of the plan. Tools used to manage bison abundance and distribution in the future would include roundup and translocation, hazing, and lethal removal.

Alternative 4 — Elk management under this alternative would include the same non-lethal and lethal management tools and actions as Alternatives 2 and 3. Under this alternative, the NPS would acquire the Medano Ranch with no bison, but would amend the GMP so that after a period of 5–7 years, the NPS would establish a new conservation herd to be managed within the recommended density. Tools used to manage bison abundance and distribution in the future would include roundup and translocation, hazing, and lethal removal.

Environmental Consequences

The summary of environmental consequences considers the actions being proposed and the cumulative impacts from occurrences inside and outside GRSA. The potential environmental consequences of the actions are addressed for vegetation, elk and bison, wilderness character, archeological resources, and socioeconomics: game damage. The following table is a summary of the environmental consequences.

Summary

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Vegetation				
Impacts to Wetland Vegetation Communities	<p>Prior to the removal of bison from the Medano Ranch, current overconcentration of elk and bison would continue and ecological conditions would likely worsen over time.</p> <p>Following removal of bison, the ecological condition of wetland vegetation communities could improve. However, elk use and overconcentration would continue (and could increase) and impacts to wetland vegetation communities as a result of grazing and browsing, erosion and soil compaction, creation of game trails, introduction of invasive species, and alteration of height and structure in woody species dominated communities could worsen over time when compared to current conditions.</p>	<p>Elk management to reduce the overconcentration of elk in wetland vegetation communities would reduce the level of impacts from elk overuse and would likely improve the ecological condition of wetland communities.</p> <p>The removal of bison would likely result in further improved ecological condition of wetland vegetation communities.</p>	<p>Elk management and reduction of bison density after 5–7 years would likely benefit the ecological condition of wetland communities (similar to Alternative 2).</p>	<p>Elk management and a transition period of 5–7 years with no bison followed by reintroduction of bison would likely benefit the ecological condition of wetland communities (similar to Alternatives 2 and 3).</p> <p>Having no bison during the transition period (and redistributing elk from areas of overconcentration) would likely result in relatively rapid improvement of ecological condition of wetland communities.</p> <p>Once bison are reintroduced, ecological conditions could decline temporarily. However, given continued successful elk management and continued adaptive monitoring, wetland ecological conditions would likely stabilize and become sustainable.</p>
Elk and Bison				
Impacts to Elk Population	<p>Elk overconcentration and high levels of herbivory could continue in the absence of active elk management, likely resulting in continued habitat degradation and high levels of intraspecific competition in portions of their range, which can increase stress for individual elk and affect overall herd productivity and growth if conditions worsen over time.</p> <p>Prior to the removal of bison from the Medano Ranch, the current condition and trends created by elk and bison interactions would likely continue, resulting in continued interspecific competition in certain areas and potentially reduced forage quantity and quality in those areas.</p> <p>Following removal of bison, the condition of habitat on the Medano Ranch could improve from reduced browsing pressure potentially providing more habitat and forage available for elk. However, elk concentration on the Medano Ranch could increase as a result, potentially off-setting any benefits.</p>	<p>Active elk management tools associated with dispersal (i.e., hazing and lethal removal for dispersal) would disrupt and displace individual elk and groups of elk and could result in increased stress and the direct mortality of up to 40–200 elk each year; however, redistribution of the elk population could benefit elk habitat over the long term by reducing herbivory and intraspecific competition in areas of overconcentration and allowing degraded habitat the opportunity to recover. Similarly, removal of bison from the landscape would remove more than 1,700 bison from the landscape and a source of interspecific competition (same as Alternative 1).</p> <p>Additional exclosure fencing would prevent elk from foraging in some of the more productive areas of the Park, but would allow these areas the opportunity to recover, benefitting elk over the long term from improved habitat and forage quality and quantity.</p>	<p>The impacts of active elk management (i.e., fencing, hazing, and lethal removal for dispersal) on elk and the potential habitat and forage improvements associated with active management would be the same as Alternative 2.</p> <p>Substantially reducing the number of bison on the landscape would benefit elk by reducing elk-bison competition for local resources. The potential to establish and expand the range and distribution of a bison herd in the Park would likely alter the locality of interspecific competition between elk and bison, which could adversely impact elk habitat in new areas; however, the impacts would likely be marginal because of the reduced bison density.</p> <p>Improved habitat conditions could also attract additional elk to the Park or retain individuals and groups for longer periods of time, potentially off-setting the habitat benefits of bison reduction.</p>	<p>The impacts of active elk management (i.e., fencing, hazing, and lethal removal for dispersal) on elk and the potential habitat and forage improvements associated with active management would be the same as Alternatives 2 and 3.</p> <p>Bison removal for the first 5–7 years following NPS acquisition of the Medano Ranch would result in the same impacts to elk and elk habitat as Alternatives 1 and 2. Following the 5- to 7-year transition period, the impacts of incorporating bison into park management on elk and elk habitat would be the same as Alternative 3.</p>
Impacts to Bison Population	<p>Alternative 1 is expected to have no effect on bison, as current trends and conditions would not change in the absence of active elk management, and the bison herd would be removed prior to NPS acquisition of the Medano Ranch.</p>	<p>If bison are still on the landscape when active elk management begins, there could be indirect impacts to bison as a result of active elk management actions. However, Alternative 2 would likely result in negligible impacts to the existing bison herd, as it is likely that bison would be removed prior to implementation of any active elk management and improvements to habitat and ecological condition would not occur prior to bison removal.</p>	<p>Tools used to manage the bison population could result in harassment and injury or direct mortality of individual bison, and similar indirect adverse impacts could result from tools used to actively manage the elk population in the Park. However, bison habitat could benefit over the long term from the redistribution of elk across the landscape and the subsequent habitat improvements. Additional benefits could result from reduced competition and increased foraging opportunities, as the number of bison on the landscape would be substantially reduced and the bison range could expand.</p>	<p>Prior to NPS acquisition of the Medano Ranch, impacts to bison would be the same as Alternative 2. After 5–7 years following acquisition, impacts to bison would be similar to those described for Alternative 3.</p>

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Wilderness Character				
Impacts to Wilderness Character	<p>Unmanaged elk populations are consistent with the natural and untrammled values of wilderness. However, taking no action to actively manage the distribution of elk in the Park could adversely impact the natural quality of wilderness character in those areas.</p> <p>Vegetation research and monitoring in the Park adversely affects the untrammled quality of wilderness, from the presence of exclosures or the use of motorized vehicles to access areas of interest. However, these monitoring efforts support the long-term establishment of a more naturally-functioning ecosystem, which would improve the natural quality of wilderness.</p> <p>Removal of bison from the landscape could result in both adverse and beneficial impacts to the naturalness of wilderness character in the Park. The removal of the existing bison fence would benefit undeveloped qualities of wilderness in the affected areas.</p> <p>There would likely be no impacts to wilderness in the Preserve from the no-action alternative, because most of the elk concentration areas do not occur in the Preserve and the majority of existing management actions occur in the Park.</p>	<p>Alternative 2 would adversely impact wilderness values (untrammled, undeveloped, natural, and primitive recreation) in the Park, from tools used to actively manage and disperse the elk population (i.e., monitoring and data collection, fencing, hazing, and lethal removal for dispersal). Actions involving elk management in wilderness that involve a prohibited use would be reviewed in a minimum requirements analysis, and would be allowed to proceed only if it is determined that the minimum level of activity and disruption of wilderness qualities would be used. Alternative 2 would also benefit the natural quality of wilderness in the Park by redistributing the elk herd and reducing impacts of herbivory in areas of wilderness where wetland vegetation communities are degraded.</p> <p>The impacts of research and monitoring under Alternative 2 would be similar to Alternative 1, with additional impacts from ungulate research and monitoring and future exclosures.</p> <p>The impacts of removing bison from the landscape, as well as existing bison fencing, would be the same as Alternative 1.</p>	<p>The impacts of tools used to actively manage and disperse the elk population (i.e., monitoring and data collection, fencing, hazing, and lethal removal for dispersal) on wilderness character would be the same as Alternative 2.</p> <p>Benefits to wilderness character (natural) could result from incorporating bison into park management, especially if GRSA were to expand the bison range in the Park.</p>	<p>The impacts of tools used to actively manage and disperse the elk population (i.e., monitoring and data collection, fencing, hazing, and lethal removal for dispersal) on wilderness character under Alternative 4 would be the same as Alternatives 2 and 3.</p> <p>Bison removal for the first 5–7 years following NPS acquisition of the Medano Ranch would result in the same impacts to wilderness character as Alternatives 1 and 2. Following the 5- to 7-year transition period, the impacts of incorporating bison into park management on wilderness character would likely be the same as Alternative 3.</p>
Archeological Resources				
Impacts to Archeological Resources	<p>Continued overconcentration of ungulates would constitute an adverse effect on archeological resources by contributing to near surface sediment erosion, which can expose archeological sites, and lead to a loss of physical integrity and illicit artifact collection by the public. Loss of physical integrity from erosion and the loss of artifacts affect the ability of archeological properties to convey significance and to contribute information important to the interpretation of prehistory.</p> <p>Once bison are removed from the Medano Ranch prior to NPS acquisition, archeological sites that may have been affected by overconcentration in areas where bison are located could stabilize over time, thus, preventing future impacts from bison. However, the initial effect from bison overconcentration may be irretrievable, and it is possible that elk concentration could increase in areas where bison no longer graze.</p>	<p>Actions taken to redistribute the elk herd within the Park (i.e., fencing, hazing, and lethal removal for dispersal) would have a beneficial effect on archeological properties by reducing overconcentration in areas where archeological properties may occur.</p> <p>Exclosure fencing construction and maintenance has the potential to affect archeological properties. Effects to archeological properties during exclosure fencing construction would be minimized or entirely mitigated by conducting an archeological survey to identify properties and implementing avoidance measures.</p> <p>Potential adverse effects to archeological sites from bison would continue to occur until NPS acquisition of the Medano Ranch, at which point, bison would be removed and the on-going effects from bison trampling and erosion would be minimized.</p>	<p>The impacts of active elk management (i.e., fencing, hazing, and lethal removal for dispersal) on archeological resources would be the same as Alternative 2.</p> <p>Effects to archeological properties from bison remaining on the landscape would be similar to those identified for elk under Alternative 1 (i.e., trampling and erosion), particularly during the 5-7 year transition period. However, over the long term, the substantial reduction in the number of bison from the current herd would partially alleviate on-going adverse effects from overconcentration in archeologically sensitive areas by reducing the area affected by erosion. Bison roundups would also temporarily increase the potential for trampling of surface archeological sites as they are herded towards the corral, which would constitute an adverse effect on archeological properties.</p> <p>Effects from proposed bison fencing would be the same as those described for exclosure fencing under Alternative 2 and would be minimized using the same methodology.</p>	<p>The impacts of active elk management (i.e., fencing, hazing, and lethal removal for dispersal) on archeological resources under Alternative 4 would be the same as Alternatives 2 and 3.</p> <p>Bison removal for the first 5–7 years following NPS acquisition of the Medano Ranch would result in the same impacts to archeological resources as Alternatives 1 and 2. Following the 5- to 7-year transition period, the impacts of incorporating bison into park management on archeological resources would likely be the same as Alternative 3.</p>

Summary

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Socioeconomics: Game Damage				
Impacts to Game Damage Potential	No actions to reduce the elk herd and the potential for the local elk population to increase once bison are removed from the Medano Ranch (due to reduced forage competition) could increase the potential for game damage. Elk would continue to take refuge in the Park during the hunting season and migrate into neighboring irrigated agricultural fields during the spring and summer. As the population increases and forage in the Park becomes less available, the elk could be attracted to crops on the irrigated agricultural land on neighboring properties.	A reduction of the total number of elk and reduced competition (due to the complete removal of bison) for forage in the Park could result in lower game damage potential. However, if elk redistribution efforts resulted in more elk moving onto agricultural fields, then game damage potential would increase. Coordination with partners for hunting and dispersal efforts outside the Park along with efforts in the Park, could result in further reducing game damage as well as minimizing the potential for elk to redistribute to agricultural land.	Impacts associated with the significant reduction of the number of bison on the landscape following the 5- to 7-year transition period would not differ measurably from the complete removal of bison on the landscape in terms of game damage potential. Therefore, impacts from game damage under this alternative would be similar to those described under Alternative 2 (beneficial if elk are redistributed and harvested; adverse if redistribution efforts result in more elk moving onto agricultural fields). It is unknown if expansion of the bison range could result in elk moving onto the surrounding agricultural fields.	Alternative 4 differs from Alternative 3 in that bison would be removed completely from the landscape for 5–7 years while elk management actions would be the same. Overall, impacts would be similar to those for Alternative 3: if elk redistribution were successful and resulted in a reduction of the total number of elk and, due to the reduced number of bison, competition for forage in the park was reduced, then the game damage potential would likely be reduced under Alternative 4. However, if elk redistribution efforts resulted in more elk moving onto agricultural fields, then game damage potential would likely be increased.

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CHAPTER 1: Purpose of and Need for Action



CHAPTER 1: PURPOSE OF AND NEED FOR ACTION

PROJECT BACKGROUND

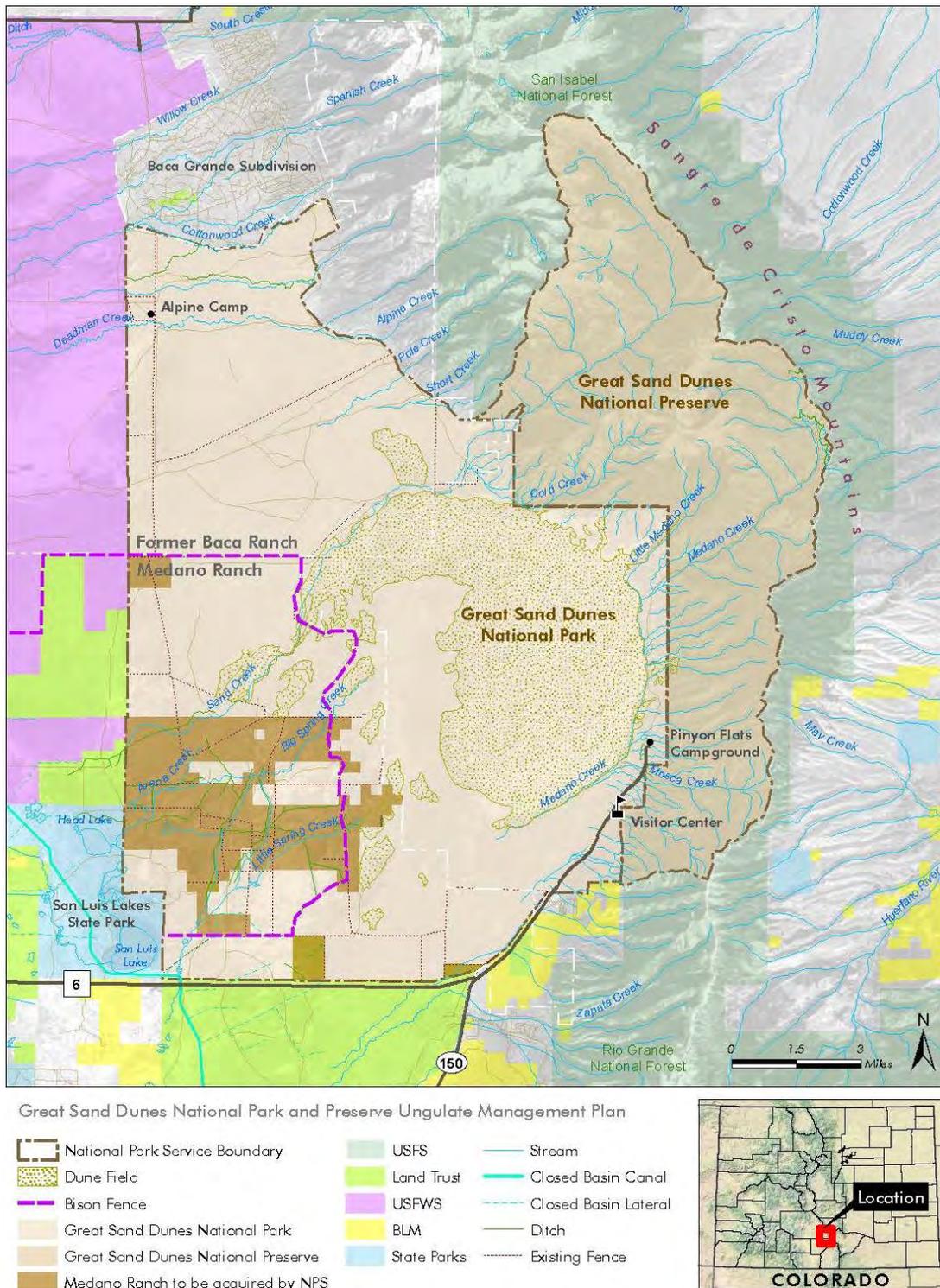
Great Sand Dunes National Park and Preserve (GRSA²), located in the high San Luis Valley of south-central Colorado (see Figure 1), was originally established in 1932 as Great Sand Dunes National Monument “for the preservation of the Great Sand Dunes and additional features of scenic, scientific, and educational interest.” In November 2000, the Great Sand Dunes National Park and Preserve Act authorized expansion of the national monument into a national park and preserve that encompasses more than 149,000 acres, which is almost four times the size of the original monument. The purpose of this expansion was to protect the dunes system and the interrelated fundamental resources of GRSA. Over half of the land in GRSA is comprised of grasslands, shrublands, and wetlands, which are part of a fragile, dynamic system that influences and sustains the dunes, a huge deposit of pure sand nestled against the Sangre de Cristo Mountains. A feature associated with the dunes known as the sand sheet surrounds the main dune mass. The sand sheet is stabilized by grasses and other low growing plant life (National Park Service [NPS] 2007).

The combined General Management Plan (GMP) / Wilderness Study for the expanded GRSA was approved in 2007 (NPS 2007). One component in the Record of Decision for the GMP was the voluntary acquisition of the Medano Ranch from The Nature Conservancy (TNC). The Medano Ranch land is in both the congressionally authorized Park boundary and that of the Baca National Wildlife Refuge (NWR) on the valley floor. TNC currently manages a bison herd on this land (Figure 1). Although there are no free-ranging populations of wild bison in Colorado, they are native to the San Luis Valley. The bison population currently managed by TNC on the Medano Ranch is the only herd in the San Luis Valley.

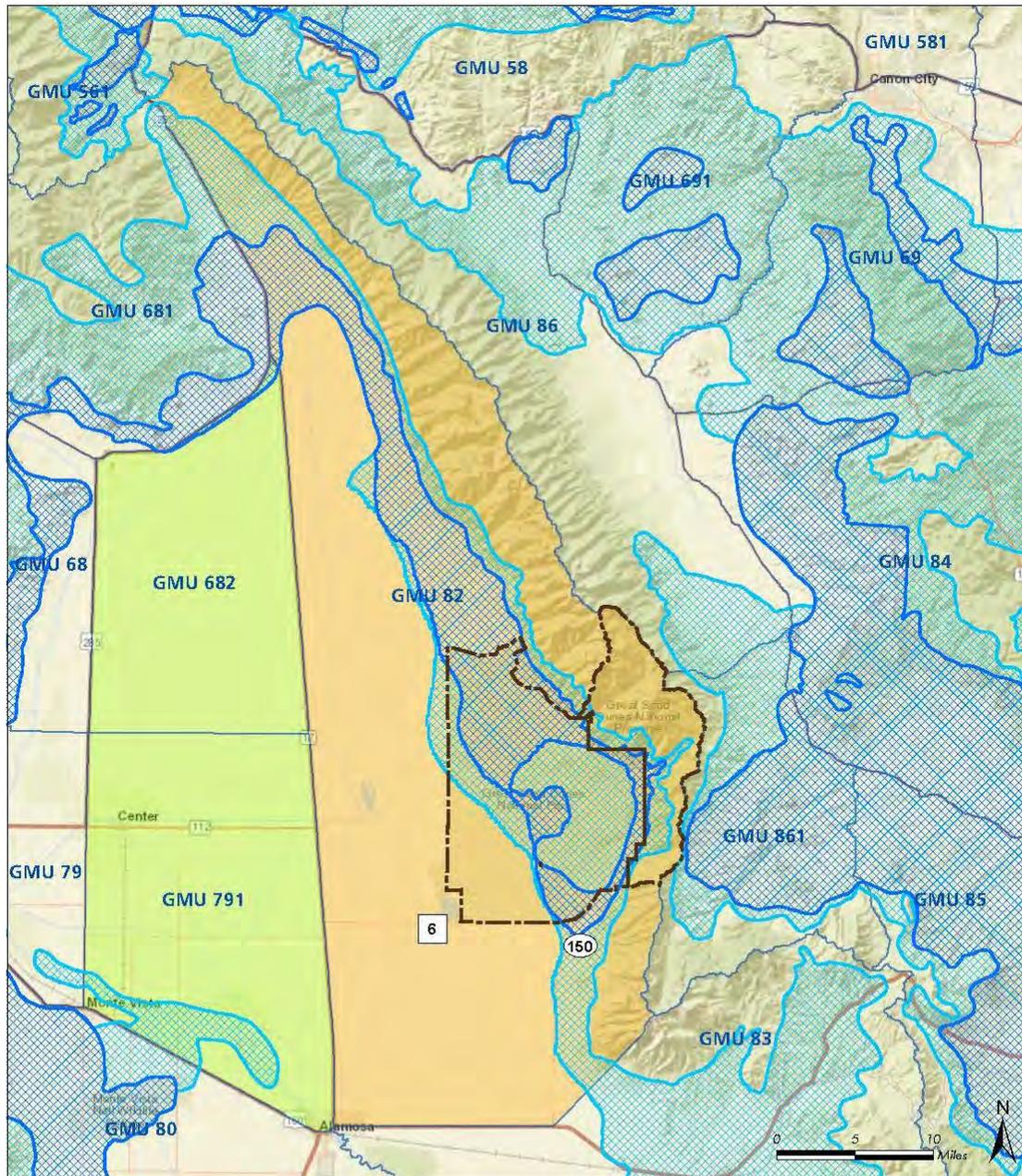
The GMP discussed continuing to work with partners, including Colorado Parks and Wildlife (CPW), the U.S. Fish and Wildlife Service (USFWS), the U.S. Forest Service (USFS), TNC, and park neighbors to develop management strategies for elk and bison. The Park is considered year-round habitat for elk, a native species in Colorado. In the San Luis Valley, historically elk have migrated seasonally from winter range on the valley floor to higher elevation summer range. Over the past 20 years a portion of the herd has transitioned to year-round residency on the valley floor. Based on a review of CPW data for the area containing GRSA (Data Analysis Unit [DAU] E-11 or Game Management Unit [GMU] 82; see Figure 2), 47 percent of DAU E-11 is winter range (511 square miles) and 31 percent (338 square miles) is severe winter range. Of the 338 square miles of severe winter range, 53 percent is on public lands, 20 percent of which is NPS (CPW 2010; NPS 2015a). Therefore, the expected NPS wintering elk population on NPS lands would be approximately 20 percent of the total elk population if all winter range was of equal quality. Available data from 2006 through 2017 show that an average of 75 percent of the total elk population in DAU E-11 utilizes the Park as winter range during the mid-winter period (January and February) (CPW 2017; NPS 2015a). This is a significantly higher percentage than anticipated based solely on the percent of winter range availability in the Park. Additionally, it is much higher than occurs on adjacent winter ranges.

² Hereafter referred to as GRSA when referring to the park and preserve, Park when referring only to the Park, and Preserve, when referring only to the Preserve.

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Chapter 1: Purpose of and Need for Action



Great Sand Dunes National Park and Preserve Ungulate Management Plan

- National Park Service Boundary
- Elk Severe Winter Range
- Elk Winter Range
- CPW Game Management Unit Boundaries
- DAU E-11
- DAU E-55

Prepared for: NPS
 File: 4419 CPW GameUnits.mxd (dlf)
 February 23, 2018

Information on this map is provided for purposes of discussion and visualization only.

Habitat information:
 Colorado Parks and Wildlife October 2017

Figure 2. Game management units and elk winter range in and near the San Luis Valley

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There are several factors presumably contributing to the uneven distribution of elk on winter range, including more wetlands and more standing forage in the Park that has not been removed for hay and lack of grazing cattle or sheep in the Park, which occur on adjacent lands; as well as proximity of habitat to roadways and other human disturbances. Studies have found that this uneven distribution has resulted in concentrations of elk (Figure 3) that are currently having negative impacts on vegetation (Schweiger et al. 2017; Schoenecker 2012; Zeigenfuss and Schoenecker 2015).



Figure 3. Large elk herd on GRSA during winter
Source: NPS

The GMP concluded that the NPS should focus on developing an elk management plan to address these concerns of elk in the Park as a result of the uneven distribution of elk across the landscape, particularly across the valley floor, and the overconcentration of elk on the winter range. The GMP also concluded that an NPS-managed bison herd was not feasible for the life of the GMP, but that if additional bison habitat became available at some time in the future, the option could be reconsidered by the NPS (NPS 2007). The NPS anticipates receiving Land and Water Conservation Funds for the acquisition of the Medano Ranch from TNC, which was called for in the GMP, and which has created the opportunity to revisit this decision from the GMP.

PURPOSE OF AND NEED FOR ACTION

Purpose of the Plan

The purpose of this Ungulate Management Plan / Environmental Impact Statement (UMP/EIS) is to determine the appropriate future management of elk and bison in GRSA that supports long-term protection of resources and is compatible with conditions and management activities across the broader eastern San Luis Valley landscape, to the extent practicable.

Need for Action

This planning effort is needed because of the following:

- Elk and bison are currently on the landscape and there is no plan to address their management and impacts, both positive and negative, in support of desired habitat conditions.

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- Disproportionate elk use in sensitive and highly productive/diverse areas of the Park are leading to adverse impacts, particularly in wetland vegetation communities. In addition, the existing bison herd spends a disproportionate amount of time using these same vegetation communities, particularly during winter when elk overconcentration is the highest (NPS 2015a; Schoenecker et al. 2015; Schoenecker and Lubow 2016; Wockner et al. 2015).
- Bison are currently managed by TNC on the Medano Ranch and portions of the Park and a decision is needed to determine whether to have bison at GRSA in the future and, if so, how to manage them.
- The Department of the Interior (DOI) Bison Conservation Initiative and the NPS Call to Action (Back Home on the Range), combined with additional information about bison and bison habitat in the San Luis Valley, provides an opportunity to reexamine the potential for bison conservation following the 2007 GMP.

Objectives in Taking Action

In the context of NPS National Environmental Policy Act (NEPA) reviews, objectives are more specific statements of purpose that provide additional bases for comparing the effectiveness of alternatives in achieving the desired outcomes of an action. Using GRSA's enabling legislation, mandates and direction in other planning documents, service-wide objectives, National Park Service *Management Policies 2006* (NPS 2006), and the National Park Service *Organic Act of 1916* (54 USC 100101(a)), the following management objectives were identified relative to elk and bison management at GRSA.

Elk and Bison

- Identify effective management tools and develop a framework to guide how and when they would be used.
- Support the attainment of desired habitat conditions as specified in this plan.
- Enhance agency understanding of ungulate habitat selection and the influence of ungulate herbivory.

Visitor Experience

- Enhance public awareness and understanding of the ecological role of elk and bison on the landscape.

Park Management and Operations

- Develop and implement an adaptive management program to increase understanding of ungulate-habitat relationships and incorporate that information into future management.

DESIRED CONDITIONS

Desired conditions are a park's natural and cultural resource conditions that the NPS aspires to achieve and maintain over time, and the conditions necessary for visitors to understand, enjoy, and appreciate those resources (NPS 2006). The desired condition for the landscape at GRSA, which is connected to the purpose, need, and objectives of this UMP/EIS, is a system where ungulate populations are managed to facilitate and sustain biodiversity and fully functioning ecosystems. One of the constraints to this is the existing degraded conditions and type conversion that exists as a result of long-term livestock grazing over the past 100+ years.

GRSA strives to maintain a healthy diversity and pattern of vegetation communities including various seral stages and to approximate the natural diversity and abundance of native flora and fauna as far as is practical for park management to achieve. The basis for developing specific reference conditions will include the archeological record, historical and scientific literature, and ongoing inventory, monitoring, and research (especially adaptive management and monitoring carried out for the purposes of ungulate management). Landscape management supporting such habitat conditions provides for ecological resiliency in light of other contemporary environmental stressors such as climate change, which in turn enhances the conservation potential of GRSA.

Wetlands at GRSA include marshes, salt flats, wet meadows, and riparian communities (some dominated by cottonwoods and willows) and are hotspots of biological diversity that perform many ecologically vital "ecosystem services" such as providing habitat for diverse wildlife species including ungulates. They are also sought after and appreciated by park visitors, especially in an arid landscape like GRSA. Because of this, GRSA should support a diverse array of ecologically healthy and minimally disturbed wetland communities across the landscape.

Desired conditions should go beyond narrative statements about what the NPS would like to achieve and maintain over time. Where possible, the NPS seeks to represent desired conditions using quantified metrics that provide indicators that can be monitored, that reflect the type and scale of information that supports adaptive management, and that provide a framework for selecting among possible responses to unforeseen resource response.

With this in mind, the NPS has identified initial elk and bison population goals to meet these desired conditions: 1) redistributing elk so that the wintering elk population in the Park is 40 percent of the total elk population in the DAU, as described in the "Active Elk Management" section of Chapter 2; and 2) for alternatives that retain bison on the landscape (Alternatives 3 and 4), managing the bison population between 0.001 and 0.01 bison per acre. Within 3 to 5 years of implementing the plan, the NPS would also develop metrics of ecological integrity and vegetative condition which further quantify desired conditions for wetlands on the landscape (see "Adaptive Management" section of Chapter 2).

SCOPE OF THE ENVIRONMENTAL IMPACT STATEMENT

Through the course of developing this EIS, the NPS has continued to evaluate what decisions can be made at this time related to managing elk and bison at GRSA. This evaluation has been

informed by past and ongoing efforts to understand the relative contributions of elk and bison to impacts on sensitive wetland environments in the Park. Current evidence suggests that effects of elk on wetland vegetation communities are a result of disproportionate use of these sensitive habitats (as opposed to overall population abundance). The above factors along with evolving views on bison conservation, and the potential for the NPS to acquire the Medano Ranch from TNC, as envisioned in the GMP for GRSA, defined the scope of this EIS.

The NPS is able to analyze the environmental impacts of elk management tools in detail in this EIS because there is specific information regarding the use of these tools and their potential effects. However, for bison, potential management tools under Alternatives 3 and 4 and their environmental impacts are analyzed programmatically in this EIS. This is because NPS management actions are not expected to occur for approximately 5 to 7 years under Alternatives 3 and 4, and other management needs associated with NPS acquisition of the Medano Ranch could influence how the NPS implements such actions. As such, the specifics of bison management actions and their potential effects are unknown at this time.

As a result, the NPS is preparing this EIS to make specific decisions related to elk management tools that might be used to address overconcentration issues; and to provide a broader, higher level (or programmatic) analysis of potential decisions about the future of bison at GRSA, such as 1) whether or not to amend the GMP to allow for bison at GRSA, and if so, how many bison might be appropriate; 2) when the NPS would assume bison management responsibilities; and 3) what management tools the NPS might use upon assuming bison management responsibilities. Under NEPA, this higher level analysis is described as “programmatic,” and is intended to address the general environmental issues, impacts, and benefits relating to these broad decisions about bison. While the NPS feels it is meaningful to make these broad decisions, there is too much uncertainty at this time regarding when and how potential bison management tools would actually be implemented should the NPS select an alternative that includes bison at GRSA. If such an alternative becomes the selected action, this programmatic NEPA review for bison would support planning-level decisions and would establish parameters for subsequent, ‘tiered’ NEPA reviews, such as narrowing the range of alternatives to be considered (i.e., the NPS would not have to revisit whether or not to have bison at GRSA); and would provide a body of information that can be incorporated by reference into future planning/compliance that may be needed.

ISSUES AND IMPACT TOPICS RETAINED FOR FURTHER ANALYSIS IN THIS EIS

“Issues,” or “environmental issues,” can be problems, concerns, conflicts, obstacles, or benefits that would result from the implementation of an alternative, including the no-action alternative, considered in this UMP/EIS.

The NPS used internal, agency, and public scoping to identify issues to consider in the environmental analysis. A summary of the scoping process is presented in Chapter 5.

When determining whether to retain an issue for more detailed analysis in this EIS, the interdisciplinary team considered, among other things, whether or not:

- the environmental impacts associated with the issue are central to development of an ungulate management plan or of critical importance;

Chapter 1: Purpose of and Need for Action

- a detailed analysis of environmental impacts related to the issue is necessary to make a reasoned choice between alternatives;
- the environmental impacts associated with the issue are a point of contention among the public or other agencies; or
- there are potentially significant impacts to resources associated with the issue.

Ultimately, it is important for decision makers and the public to understand the impacts that each of the alternatives under consideration would have on specific resources. Therefore, the NPS uses “impact topics” as headings to capture the potentially significant issues associated with each resource and to organize the discussions of the affected environment (Chapter 3) and environmental consequences (Chapter 4).

Wetland Vegetation

There are 588 documented plant species within diverse vegetation communities (including rare communities) in GRSA (<https://irma.nps.gov/NPSpecies/>). However, this UMP/EIS focuses on wetland vegetation communities, which include marshes, salt flats, wet meadows, and riparian wetlands. These vegetation communities are integral to maintaining the wetlands in the Park that perform vital “ecosystem services” such as providing habitat for diverse wildlife species including ungulates. Impacts to these vegetation communities threaten the desired condition of GRSA supporting a diverse array of ecologically healthy and minimally disturbed wetland communities across the landscape.

The high water table of San Luis Valley creates an array of wetlands and wildlife habitats. Groundwater availability, among other confounding factors, strongly influences the extent and health of all plant communities in the semi-arid San Luis Valley. Groundwater flows primarily west and southwest through the Park and emerges in the southwestern portion of the Park as a line of springs. The water flowing from these springs creates large areas of lush, productive wetlands. Vegetation in these wetlands has been shown to be disproportionately preferred and used by both elk and bison for foraging, wallowing, resting, thermal cover, and shading (Zeigenfuss and Schoenecker 2015). These behaviors can become a disturbance when it results in negative impacts from how and when ungulates use habitat. These disturbances might include, for example, removal of select plant species, erosion and soil compaction caused from hoof punching, wallows or trails, and introduction of invasive species (Schweiger et al. 2017). These disturbances have been documented in most of the wetland vegetation communities resulting in reduced ecological integrity of many wetland sites in the Park. If left unmanaged, continued elk overconcentration may further damage the ecological integrity of these plant communities in the Park (Schweiger et al. 2017).

Although bison are not currently managed by the NPS, they occur on the landscape and GRSA is considering whether or not to manage a herd as part of this UMP/EIS. If an alternative is selected where bison are managed by the NPS, the number of bison on the landscape would be reduced to a much lower density range than are currently on the landscape. However, even a smaller bison herd on the landscape, competing with elk for vegetation resources, could affect wetland vegetation communities.

The importance of managing impacts from elk (and bison) overconcentration in wetland vegetation communities must take into consideration the potential for exacerbation of these impacts when combined with other confounding factors. Such as, while we understand climate change could have impacts on hydrology, there is a lot of uncertainty regarding how it could change wetlands, and wetland vegetation, in the Park. A recent study demonstrated that recent climatic conditions are already shifting beyond the historical range of variability (Monahan and Fisichelli 2014). Therefore, managing the impacts related to elk and bison overuse to these important wetland resources could minimize the indirect impacts that could occur as a result of climate change in these communities.

Impacts to the other vegetation communities in GRSA, such as the upland shrub, alpine zone, and subalpine forests, are not anticipated under this plan and are therefore not analyzed in detail. For more information on these, see “Impact Topics Considered but Dismissed from Detailed Analysis.”

Elk and Bison

Actions taken to manage elk and bison populations in GRSA would result in direct impacts on the local elk and bison populations and could affect existing habitat for both species.

Elk. Left unmanaged, overconcentration of elk in the Park adversely affects habitat structure and species diversity that provides hiding, resting, and thermal cover, as well as forage quality and quantity. Once habitat is degraded in the Park, elk would likely move to other habitats and potentially nearby federal and private properties and begin to degrade those areas. Habitat degradation across the eastern San Luis Valley (GMU 82, Figure 2) can lead to increased stress and eventually lower productivity of the herd (Johnson, Wisdom, and Cook 2005).

Active elk management actions (i.e., fencing, hazing, lethal removal for dispersal) are intended to alter distribution, movement, and behavior of elk in the Park. These actions may cause elk to re-distribute in unexpected ways and avoid certain areas in GRSA, which could result in higher competition for areas that were not targeted for dispersal activities and increased movement across GRSA. In addition, if an alternative is selected where bison are managed by the NPS, it could result in altered distribution and habitat use changes for the existing elk population. All alternatives analyzed in this UMP/EIS would result in decreased interspecific competition for habitat, as the bison population would be removed or the size of the bison population would be substantially reduced.

Bison. Although bison are not currently managed by the NPS, they occur on the landscape and GRSA is considering whether or not to manage a herd as part of this UMP/EIS. If an alternative is selected where bison are managed by the NPS, potential non-lethal and lethal management actions could impact bison behavior and movement in the Park. If bison are incorporated into park management, the size of the population would be substantially less than what currently exists on the landscape, reducing both interspecific and intraspecific competition. Elk management actions could redistribute elk from areas of overconcentration, including degraded areas on the Medano Ranch, which could result in reduced competition for resources with bison. However, management actions used to redistribute elk (e.g., hazing or any lethal actions)

could also result in indirect impacts on bison, including disturbance, and increased stress and movement.

Wilderness Character

GRSA has more than 75,000 acres of designated wilderness and approximately 53,000 acres of proposed wilderness. The 1964 *Wilderness Act* generally requires that “wilderness areas” are to be administered to provide for their protection and preserve their wilderness character. Incorporating bison into park management could provide park visitors with more bison-viewing opportunities in backcountry areas, contributing to the primitive recreation quality of wilderness. In addition, potentially expanding the bison range in GRSA at a level of abundance and density that is consistent with historic occurrences of bison could contribute to the natural quality of wilderness by restoring a native species and because bison could play a beneficial role in the maintenance of wetland vegetation communities through grazing and foraging at lower densities. However, management actions being considered (e.g., fencing, hazing, and lethal actions) could adversely affect other qualities of wilderness character, such as the untrammelled and undeveloped qualities of a landscape free of fencing, and the natural qualities of unmanaged wildlife (particularly elk). In addition, the use of noisemakers, firearms, motorized vehicles, and aircraft in or over wilderness would undoubtedly disturb the natural sounds and quiet in the Park that contribute to opportunities for solitude in wilderness. For all of the action alternatives, uses prohibited by Section 4c of Wilderness Act (i.e., motorized vehicle and aircraft) are being proposed, but would be subject to a minimum requirements analysis prior to implementation to determine if these prohibited uses are necessary to meet minimum requirements for the administration of the area as wilderness.

Archeological Resources

GRSA is rich in archeological resources, which include both the remains of prehistoric American Indian and historical (post A.D. 1821) sites. Overconcentration of ungulates contributes to near surface sediment erosion, which can expose archeological sites to deflation and loss of integrity, and lead to illicit artifact collection by the public. Some of the most significant archeological properties in the Park are located in areas of ungulate overconcentration, including wetlands and along streams. Ungulate management actions have the potential to affect archeological resources in the Park. For example, fence installation and maintenance could impact archeological properties in or near the fence alignment or resource enclosures. In addition, changes in the distribution of elk or numbers of bison could positively or negatively affect resources that are vulnerable to trampling, such as archeological sites and properties.

Socioeconomics: Game Damage

CPW’s Game Damage Program is a prevention and reimbursement program that compensates ranchers, farmers, and landowners for damage caused by big game animals, including elk. Game damage reimbursements have been minimal in the vicinity of GRSA in recent years, despite the fact that elk are found on agricultural fields (CPW 2015a). However, CPW invests a

substantial amount of funds for prevention which is managed through Habitat Partnership Programs (HPPs). A review of HPP documents for the Mount Blanca committee that address conflicts between big game and agricultural producers on the east side of the San Luis Valley indicates higher elk populations have resulted in numerous conflicts between elk and agricultural producers particularly regarding forage competition and damage to fences (Mount Blanca HPP 2010). Additionally, the amount of potential game damage could increase as the number of elk on the landscape increase. This is a particular concern in DAU E-55 (Figure 2) where the population objective for elk is zero and special hunting seasons have been implemented to manage the population as such because of the potential for game damage on agricultural fields (2 CCR 405-2; CPW 2007, 2016a). Irrigated agricultural fields where commercially grown crops include alfalfa, spinach, lettuce, potatoes, and small grains, attract elk. A common concern with the presence of elk on agricultural fields is the potential of elk spreading crop diseases into a seed potato field thereby substantially lowering the crop value. Elk management actions that are intended to alter distribution, movement, and behavior of elk in the Park may cause elk to re-distribute in unexpected ways, including redistribution onto these agricultural fields resulting in an increase in the potential for game damage. This result would be minimized by working with partners, such as CPW, to coordinate hunting and dispersal efforts outside the Park with elk management actions within the Park.

ISSUES AND IMPACT TOPICS CONSIDERED BUT DISMISSED FROM DETAILED ANALYSIS

Several potential issues and impact topics were raised during internal and public scoping. Using the same considerations noted previously, the interdisciplinary team analyzed these issues and determined they did not warrant more detailed discussion in this EIS.

Other Wildlife and Wildlife Habitat

GRSA is one of the most biologically diverse parks in North America, providing habitat for a variety of animals, including birds, mammals, reptiles and amphibians, fish, and invertebrates. There are approximately 230 species of birds, 60 mammals, 7 reptiles, 6 amphibian species, and 6 species of fish known to occur in GRSA (NPS no date [n.d.], 2005). In addition, more than 1,000 species of insects are known to inhabit the sand, soils, forests, rivers, lakes, grasslands, and mountaintops of GRSA (NPS 2015b).

Common or characteristic birds in GRSA include golden eagles (*Aquila chrysaetos*), hermit thrushes (*Catharus guttatus*), mourning doves (*Zenaida macroura*), warbling vireos (*Vireo gilvus*), mountain chickadees (*Poecile gambeli*), American robin (*Turdus migratorius*), western tanagers (*Piranga ludoviciana*), burrowing owls (*Athene cunicularia*), American avocets (*Recurvirostra americana*), Canada goose (*Branta canadensis*), great blue herons (*Ardea herodias*), hummingbirds, and several species of sparrows. Characteristic non-ungulate mammals and herptiles include snowshoe hares (*Lepus americanus*), pikas (*Ochotono princeps*), jack rabbits (*Lepus californicus*, *L. townsendii*), coyotes (*Canis latrans*), foxes (*Urocyon cinereoargenteus*, *Vulpes vulpes*), bobcats (*Lynx rufus*), tiger salamanders (*Ambystoma tigrinum* spp.), Great Plains toads (*Bufo cognatus*), greater short-horned lizards (*Phrynosoma hernandesi*), plateau lizards (*Sceloporus undulatus*), Rio Grande cutthroat trout

(*Oncorhynchus clarki virginalis*), Rio Grande suckers (*Catostomus plebeius*), and flathead minnows (*Pimephales promelas*) (NPS 2015c, 2015d).

Other ungulate species in GRSA include mule deer (*Odocoileus hemionus*), pronghorn (*Antilocapra Americana*), and bighorn sheep (*Ovis Canadensis*). Mule deer are the most commonly observed mammal, living in the montane meadows and pinyon/juniper woodlands, where the campground, entrance station, and Visitor Center are located (NPS 2015d). Pronghorn generally concentrate in the northern portions of the San Luis Valley. Most of the Park west of the dunefield is considered overall range and winter range for pronghorn, while the wetland-dominated areas immediately west of the Park (and east of Highway 17) are considered a “limited use area” (CPW 2016a). In GRSA, bighorn sheep are found in the subalpine tundra and occasionally in the subalpine forests. They are most commonly seen along the Medano Pass Primitive Road (NPS 2015d).

The no-action alternative could result in sustained or increased densities of elk if the population begins to increase. Taking no action to reduce elk overuse of important wetland vegetation communities in the Park would likely reduce their desired condition (i.e., natural biodiversity and proper ecosystem functioning). Elk overuse in these sensitive vegetation communities and the habitat they provide would be gradual as the elk population increases, but adverse impacts could last for decades. Areas severely damaged by overuse often result in reduced ecosystem functions from loss of species diversity, vegetation cover, increased erosion, and soil loss. Restoring these functions likely would take several years, intensive management and long-term funding. The impact of ungulate overuse on the ecological health of wetland vegetation communities in GRSA has been demonstrated (Scheweiger et al. 2017). According to Scheweiger et al. (2017), approximately 2,644 acres (or 62 percent) of salty meadow wetland habitat in GRSA is in less than reference condition (see Chapter 3, “Wetland Vegetation”) as a result of ungulate overuse. These changes in natural biodiversity and ecosystem functioning can lead to indirect effects on non-ungulates via altered food availability, cover from predators, or modified microenvironments (Rooney and Waller 2003; Allan et al. 2010). For example, heavy browsing, resulting from increased and/or sustained elk densities in areas of overconcentration, could alter habitat for ground-nesting birds, riparian-dependent birds, small mammals, and other vegetation-dependent and pollinating species (NPS 2007) by decreasing overall vegetation density and altering understory composition (e.g., dominance by browse-tolerant or avoided plant species, increased spread of invasive species). Predators could benefit in the short term from decreased vegetation density and altered habitat composition, as there would be less cover for certain prey, such as mice and squirrels, to hide (Marsh et al. 2014; Randa and Yunker 2004). Over the long term, potential impacts to wildlife associated with wetland vegetation communities could be detectable, especially during periods of drought or other environmental stress. However, under the no-action alternative, the removal of bison from sensitive wetland vegetation communities would reduce the impacts occurring from having two large ungulates sharing this ecosystem.

For the action alternatives, human activities associated with fencing or conducting other management actions could result in disturbance of native vegetation communities and result in a short-term reduction of forage or cover for native wildlife. Construction of fencing would be temporary, likely lasting less than one week in a particular work area, and impacts would be limited to the immediate area where the fencing is being constructed. Once installed, additional fencing could pose a threat of injury and death to individual animals, including avian species, from collision and crossing fences. However, fences would follow wildlife-friendly guidelines and

be designed to be passable to other wildlife species (Hanophy 2009), and the effects on individual animals are not expected to have any population-level effects. Proposed management activities, especially sharpshooting, use of helicopters and fixed-wing aircraft, and use of motorized vehicles, could disrupt breeding and foraging activities for other wildlife species (specifically birds and other mammals). Disruptions to breeding and foraging could cause wildlife to expend additional energy resources and increase physiological stress that could reduce reproductive success, affect rearing, and potentially reduce overall population numbers. However, populations of other wildlife are expected to remain stable because these activities predominantly occur from late July through late December, avoiding sensitive breeding and rearing stages and the harshest winter months. In addition, disturbance to wildlife would be limited to locations where management actions are implemented and immediately adjacent areas; and local wildlife would likely avoid these areas and use other available habitat until management actions are complete.

For alternatives considering NPS management of a bison herd, bison foraging patterns in a reduced herd and on an expanded range may benefit other wildlife and wildlife habitat, as grazing abundant grasses and stimulating growth of forbs and shrubs can increase available forage for other species. Schoenecker (2012) documented increased vegetation production in GRSA wet meadows grazed by both bison and elk. Active elk management could also benefit other wildlife species and associated habitat over the long term by reducing overbrowsing, which improves vegetation cover and overall habitat quality. This could improve health and fitness for more common wildlife species and potentially result in improved overall survivorship in wildlife populations in GRSA.

The no-action alternative would likely impact other wildlife at an individual scale, which may force wildlife, especially those that use wetland and riparian habitats, to seek other areas for foraging, resting, and breeding. This could result in localized reductions in abundance of these relatively common wildlife species in the GRSA. All action alternatives would potentially impact other wildlife at the individual scale, but would not affect population of non-ungulate species. Because adverse impacts from implementation of management tools associated with the action alternatives on other wildlife and wildlife habitat are not expected to have population level effects, and benefits associated with active management of elk and the presence of bison are expected once initial management actions are completed (i.e., after 7 to 10 years), issues associated with other wildlife and wildlife habitat were dismissed from further analysis.

Special Status Species and Unique Natural Resources

Federal and State-listed Species. Several federally and state-listed wildlife species are known to occur in Alamosa and Saguache Counties; however, not all of these species live in or have potential habitat in GRSA. Table 1 below provides park-specific habitat comments and reasons for dismissing each special status species from further detailed analysis. Citations for information presented in Table 1 are listed at the bottom of the table unless otherwise noted within the table. There are currently no critical habitat designations in GRSA. Based on the most recent USFWS data, there are no federally listed plant species that occur in the GRSA (USFWS 2018).

Table 1. Federally and state-listed wildlife species with potential habitat in GRSA

Species Name	Status*	Habitat Comments	GRSA Comments	Anticipated Impacts
Birds				
Southwestern willow flycatcher (<i>Empidonax traillii extimus</i>)	FE, SE	Nest primarily in swampy thickets, especially of willow, where vegetation is 12 to 21 feet (4 to 7 meters) or more in height. GRSA is outside of critical habitat.	Not present in GRSA; suitable habitat is limited.	Proposed management actions are not expected to impact Southwestern willow flycatcher, as this species is not known to live in GRSA and habitat for this species is limited to non-existent (ERO Resources Corporation 2012). The resulting condition of active ungulate management (i.e., elk dispersal) over the long term could benefit potentially suitable habitat for this species by reducing overbrowsing of willows in potential suitable habitat.
Yellow-billed cuckoo (<i>Coccyzus americanus</i>)	FT, ST	Prefers old-growth riparian woodlands with dense understories; requires patches of at least 25 acres of dense riparian forest. GRSA is outside of proposed critical habitat.	Not present in GRSA and riparian areas lack sufficient area and structure to satisfy survey requirements (Haltermann et al. 2016). A single yellow-billed cuckoo was reported in GRSA in 1984, but recent inventories did not detect the presence of this species in GRSA. Surveys in the San Luis Valley have documented this species at four locations along the Rio Grande and Conejos Rivers (Ireland 2017)	Proposed management actions are not expected to impact yellow-billed cuckoo, as this species is not known to live in GRSA. If yellow-billed cuckoos did occur in GRSA, proposed management actions to protect riparian habitats would benefit this species by increasing the ecological condition of riparian woodland trees and understory vegetation.
Mexican spotted owl (<i>Strix occidentalis lucida</i>)	FT, ST	Uncommon to rare in unlogged, closed canopy forests situated in steep canyons. Nests in caves and on cliff ledges in steep-walled canyons. GRSA is outside of critical habitat.	Not present in GRSA. Nearest known inhabitation is in the Wet Mountain to the east of GRSA. Potential habitat for this species is located in the Preserve, along the western slope of the Sangre de Cristo Mountains, however, avifaunal surveys in 2005 did not	Proposed management actions are not expected to impact this species, as this species is not known to live in GRSA.

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Species Name	Status*	Habitat Comments	GRSA Comments	Anticipated Impacts
			detect the presence of this species in GRSA (Giroir 2005).	
Bald eagle (<i>Haliaeetus leucocephalus</i>)	SC	Primary habitat includes reservoirs and rivers. In winter, they may also live locally in semideserts and grasslands, especially near prairie dog towns.	Present in the Park. Habitat includes riparian cottonwoods on the sand sheet. A winter roost site has been identified along Sand Creek, however, there are no known nesting sites in GRSA and the species is considered to be uncommon.	Proposed management actions are not expected to impact this species, as this species is not known to nest in the Park. Dispersal actions could temporarily displace eagles. Regeneration of cottonwoods and other riparian trees that provide suitable winter roost habitat is likely to increase from reduced overbrowsing.
Greater sandhill crane (<i>Grus canadensis</i>)	SC	Migrants live on mudflats around reservoirs, in moist meadows, and in agricultural areas. Breeding birds are found in parks with grassy hummocks and water courses, beaver ponds, and natural ponds lined with willows or aspens.	Present in the Park. Abundant in the central and western San Luis Valley in the fall and spring. GRSA likely provides potential stop-over habitat for this species.	Although this species is abundant in the San Luis Valley and likely to occur in Park, the larger population of the migration occurs in the central and western San Luis Valley and would, therefore, not be impacted by tools associated with active ungulate management. Dispersal actions that could temporarily displace cranes would not be conducted during migration when cranes are present. The resulting improvements to habitat condition and ecological integrity from elk redistribution and bison removal or reduction could benefit the smaller numbers of sandhill cranes that are known to occur in the Park.
Gunnison sage-grouse (<i>Centrocercus minimus</i>)	FT, SC	Sagebrush communities (especially big sagebrush) for hiding and thermal cover, food, and nesting; open areas with sagebrush stands for leks; sagebrush-grass-forb mix for nesting; wet meadows for rearing chicks. No critical habitat in area.	Not present in GRSA. One small population occurs in the San Luis Valley in sagebrush habitat at the summit of Poncha Pass more than 30 miles northwest of the GRSA.	Proposed management actions are not expected to impact this species, as this species does not occur in GRSA.
Mammals				

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Species Name	Status*	Habitat Comments	GRSA Comments	Anticipated Impacts
Canada lynx (<i>Lynx canadensis</i>)	FT, SE	Northern coniferous forests are suitable habitat. Nearly 200 lynx were released in southwestern Colorado from 1999-2008.	Not present in GRSA; though suitable habitat exists. Currently, lynx habitat in GRSA exists in the extreme northern part of the Preserve, which is designated wilderness. However, this species is not known to live in GRSA.	Proposed management actions are not expected to adversely impact this species, as this species is not known to live in GRSA and management actions would not impact lynx because there is lack of overlap in preferred habitat between lynx and elk/bison.
Townsend's big-eared bat (<i>Plecotus townsendii</i>)	SC	Found in caves and riparian areas.	Present in the Park (documented along Deadman Creek) (Colorado Natural Heritage Program [CNHP] 1998). This species is considered uncommon and migratory.	Although this species is present in the Park, it lives in an area that is not expected to be impacted by active elk or bison management. Reduced overbrowsing of riparian vegetation could improve habitat for insects and bat foraging opportunities, however, this benefit is not expected to be measurable.
North American Wolverine (<i>Gulo gulo luscus</i>)	PT, SE	The southern portion of the species' range extends high-elevation alpine portions of Colorado. Require reliably deep persistent snow late into the spring.	Not present in GRSA; though suitable habitat exists in high alpine portions of the Preserve, which is designated wilderness. However, this species is not known to live in GRSA.	Proposed management actions are not expected to adversely impact this species, as this species is not known to live in GRSA and there is lack of overlap in suitable habitat between wolverine and elk/bison.
Fish				
Rio Grande sucker (<i>Catostomus plebeius</i>)	SE	Occurs in areas near rapidly flowing water. Backwaters or banks adjacent to fast waters provide holding areas during the day.	Present in the Preserve (introduced to Medano Creek).	Although this species lives in the Preserve, it inhabits a portion of GRSA that would not be impacted by active elk or bison management.
Rio Grande chub (<i>Gila pandora</i>)	SE	Found in pools of small to moderate streams near areas of current, in association with undercut banks, overhanging bank vegetation, and aquatic plants.	Extirpated from GRSA, but under consideration for reintroduction.	Proposed management actions are not expected to impact the Rio Grande chub, as this species is not known to live in GRSA.

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Species Name	Status*	Habitat Comments	GRSA Comments	Anticipated Impacts
Rio Grande cutthroat trout (<i>Oncorhynchus clarki virginalis</i>)	SC	Found in small headwater streams; spawns in clean gravel; nursery habitat along stream margins in slower water; winter habitat includes deep pools.	Present in the Park (reintroduced to Medano Creek). Medano Creek serves as an important biological refugia for this species, because it is a closed system where exotic species cannot enter.	Although this species lives in the Preserve, it inhabits a portion of GRSA that would not be impacted by active elk or bison management.
Greenback cutthroat trout (<i>Oncorhynchus clarki stomias</i>)	FT, ST	Cold water streams and lakes with adequate spawning habitat (riffles), often with shading cover; young shelter in shallow backwaters.	Not present in GRSA; not within the Colorado River basin.	Proposed management actions are not expected to impact this species, as this species does not occur in the GRSA.
Bonytail chub (<i>Gila elegans</i>)	FE, SE	Perennial rivers and streams within the Colorado River basin.	Not present in GRSA; not within the Colorado River basin.	Proposed management actions are not expected to impact these species, as these species do not occur in GRSA.
Colorado pikeminnow (<i>Ptychocheilus Lucius</i>)	FE, ST			
Humpback chub (<i>Gila cypha</i>)	FE, ST			
Razorback sucker (<i>Xyrauchen texanus</i>)	FE, SE			
Insects				
Uncompahgre fritillary (<i>Boloria acrocne</i>)	FE	Moist alpine slopes above 12,000 feet with extensive snow willow (<i>Salix nivalis</i>) patches which serve as the larval foodplant.	Not present in GRSA; though suitable habitat exists. GRSA is located at the extreme southeast edge of its potential range.	Proposed management actions are not expected to adversely impact this species, as this species is not known to occur in GRSA.

Sources: NPS 2007, 2017; USFWS 2018

*Status codes:

- FE = Federally Endangered
- FT = Federally Threatened
- PT = Proposed Federally Threatened
- SE = State Endangered
- ST = State Threatened
- SC = State Special Concern (not a statutory category)

Species of Conservation Concern. There are several species of conservation concern in GRSA, including rare insects that are considered endemic to the Great Sand Dunes. Over 1,000 species of insect are known to inhabit the sand, soils, forests, rivers, lakes, grasslands, and mountaintops of GRSA. Because extensive fields of sand have been in the area for thousands of years, several insects have become specially-adapted to live in the sandy environment (NPS 2015c). At least seven species of insects—including five beetles, one moth, and one fly—are endemic to the dunefield and sand sheet ecosystems at GRSA. These endemic species include the Great Sand Dunes tiger beetle (*Cicindela theatina*), circus beetle (*Eleodes hirtipennis*), Werner's ant-like flower beetle (*Amblyderus weneri*), Triplehorn's ant-like flower beetle (*Amblyderus triplehorni*), clown beetle (*Hypocaccus* [undescribed species]), noctuid moth (*Copablepharon* [undescribed species]), and robber fly (*Proctacanthus* [undescribed species]) (NPS 2015b). Other species associated with the Great Sand Dunes include Ord's kangaroo rat (*Dipodomys ordii*), silky pocket mouse (*Perognathus flavus*), plains pocket mouse (*Perognathus flavescens*), and northern pocket gopher (*Thomomys talpoides*).

Three plant species considered rare by the CNHP have been documented at GRSA; Smith's draba (*Draba smithii*), James catseye (*Cryptantha cinerea* var. *pustulosa*), and Slender spider flower (*Cleome multicaulis*) (CNHP 2004). Smith's draba is a globally imperiled species that is only known from 16 locations in Colorado, and nowhere else in the world, which points to the significance of the two locations of this species at GRSA (CNHP 2004). Although the Slender spiderflower is also known from a fairly wide range continuing south into Mexico, the most vigorous populations known are found in the San Luis Valley of Colorado and is known from one location in GRSA (Salas et al. 2011). James catseye is rare species that is known from four locations at GRSA. In Colorado, the James catseye is known from a total of seven locations, and four of these are in the GRSA (CNHP 2004).

As described above for wildlife and wildlife habitat, the no-action alternative could result in sustained or increased densities of elk if the population begins to increase. The no-action alternative would likely impact some species of conservation concern at an individual scale. Over the long term, potential adverse impacts of the no-action alternative would be expected to be detectable mostly within wetland vegetation communities. Upland shrub vegetation communities play an important role in the maintenance of the dunefield and sand sheet ecosystems. If left unmanaged, continued elk overconcentration may damage the function and diversity of the upland shrub communities in the Park. However, these impacts are more likely to occur in wetland vegetation communities, where elk and bison are known to concentrate and negative impacts are documented. It is possible that low-intensity grazing (especially if coupled with drought) from sustained and/or increased densities of elk in the Park could impact habitat for species of conservation concern that are known to use the upland shrub vegetation communities in the Park (e.g., Ord's kangaroo rat, silky pocket mouse, plains pocket mouse, and northern pocket gopher). Currently, the dunefield and surrounding habitat that species of conservation concern rely on are not known to be impacted by elk overconcentration in the Park. Therefore, it is possible that elk overconcentration in the Park would have no or minimal impact on the dunefield and surrounding habitat.

Elk and bison management actions proposed under the action alternatives (e.g., hazing, fence construction, lethal removal) are not expected to result in impacts on the dunefield and sand sheet communities and their associated species of conservation concern, because elk and bison are not likely to concentrate in the dunefield and sand sheet communities and dispersal

actions are not likely occur in these habitat types. Ground-based dispersal actions would likely have minimal adverse impacts because they would be concentrated on existing roads (or two-tracks) and are expected to be substantially less than current bison management and round-up activities on the Medano Ranch portion of the Park. However, elk management actions intended to alter distribution of elk in the Park may cause elk to re-distribute in unexpected ways. This could result in increased occurrences of elk in sand sheet and upland shrub vegetation, which could disrupt individual species of conservation concern, particularly small mammals known to occur throughout the valley floor (e.g., Ord's kangaroo rat, silky pocket mouse, plains pocket mouse, and northern pocket gopher), from increased stress and/or habitat disturbance caused by elk. If elk disperse to areas where species of conservation concern are known to occur, it would likely be for short periods of time while the management actions were ongoing. It is unlikely that elk would concentrate in these areas for extended periods of time. Based on these factors, adverse impacts to species of conservation concern are expected to be minor and would not contribute to the threats to or current status of the species. However, it is unknown at this time where elk would disperse as a result of active management and can only be determined through future monitoring and observation.

It is expected that the alternatives and actions being considered (including reduced bison density in the Park and adaptively managing bison and elk to meet desired conditions) would result in less ungulate use in habitats that support species of conservation concern. Likewise, the removal of bison under the no-action alternative would also result in less ungulates in this habitat. Less ungulate use could lead to increased vegetation cover, and thus, increased habitat quality and quantity for wildlife species in the Park, including species of conservation concern. Increased cover and available habitat could lead to improved health and fitness for some species of conservation concern in the park. As a result, these species are not carried forward for additional analysis.

Ecologically Critical Areas. Ecologically critical areas (ECAs) can be defined as “special ecosystems that serve unique functions and are small in area or are unusually fragile relative to others” (Conservation Foundation 1984). The NPS, working with CNHP, has identified ECAs at GRSA called “potential conservation sites.” The CNHP delineates potential conservation sites as areas and ecological processes that are necessary to support elements of natural heritage significance in Colorado. Through the GMP planning process, ECAs in GRSA were defined as CHNP potential conservation sites ranked as B1 (outstanding significance) or B2 (very high significance). The following sites were designated ECAs because they contain endemic species with restricted ranges, support globally rare species, or support high concentrations of wetlands and rare riparian associations:

- *Great Sand Dunes Potential Conservation Site* — estimated at 103,640 acres, encompasses the massive active sand dunes, the sand sheet with its grass and shrub communities, interdunal wetlands, Sand Creek, and Medano Creek. It has been assigned a biodiversity rank of B1—outstanding significance (CNHP 1998).
- *Deadman Creek Potential Conservation Site* — estimated at 3,500 acres, encompasses nearly the entire Deadman Creek watershed from the Sangre de Cristo Range (12,300 feet) to the floor of the San Luis Valley (7,600 feet). It has been assigned a biodiversity rank of B2—very high significance (CNHP 1998).

- *San Luis Lakes / Sand Creek Potential Conservation Site* — estimated at 35,000 acres, includes the Big Spring area, which has been designated a Colorado Natural Area (named Indian Spring Natural Area) by the Colorado Natural Areas Program (Colorado Natural Areas Program 2005). The site includes San Luis Lakes State Park and the watershed of Sand Creek and Big Spring Creek, which flow into San Luis Lake. It has been assigned a biodiversity rank of B2—very high significance (CNHP 1998).

Current and/or increased density of elk in the Park (i.e., no action) could adversely impact ECAs if habitat and species diversity was altered in areas where elk are over-concentrated. Although the designation of these areas would not be impacted, it is possible that limited impacts on resources in these areas (such as species composition in wetland vegetation communities and plant mortality on the sand sheet) could result from proposed management actions. Impacts on wetland vegetation communities are addressed under “Wetland Vegetation” impacts, and impacts to wildlife (including those characteristic of these ECAs) are dismissed above. Generally, effects on ECAs (and resources associated with these areas) from the action alternatives would be beneficial, as elk overconcentration and bison numbers in GRSA would be reduced compared to current conditions. Likewise, under the no-action alternative, bison would be completely removed so overall impacts from ungulate use would be reduced. Because the alternatives analyzed in this UMP/EIS would not alter the value and designation of these ECAs, this topic was dismissed from further analysis.

Upland Shrub Vegetation Communities

Upland shrub communities, including comprised of rabbitbrush-dominated, greasewood (*Sarcobatus vermiculatus*)-dominated, and rabbitbrush/greasewood co-dominated communities, are an important component of the GRSA landscape and are generally considered to be grazing-resilient. Rabbitbrush-dominated habitat is the most abundant habitat type on the valley floor in the areas that are used by elk or bison, or both. Greasewood-dominated habitat is also very prevalent in the areas that are used by elk or bison, or both.

The upland shrub vegetation communities are likely used somewhat by elk, but may be a more primary component of pronghorn and deer diets. Bison do not typically browse woody plants to any great extent but can cause damage to woody species through horning and rubbing (Zeigenfuss and Schoenecker 2015).



Figure 4. Elk and bison moving through a shrubland community below the dunes
Source: NPS

Vegetation such as rabbitbrush is important as it may facilitate survival of the understory herbaceous species, particularly when precipitation is below average, by dampening temperature fluctuations, raising humidity, decreasing wind speed, reducing irradiance, and increasing soil moisture to the underlying plant canopies (Peek and Forseth 2003). Maintaining this herbaceous understory is critical as roots from these species hold the loose sand in place. When understory herbaceous plants decrease, sand movement may occur.

It is unknown if these communities are being/have been impacted by existing levels of ungulate use. As demonstrated in Figure 4, it is known that elk and bison currently cohabitate in these areas. If elk and bison in these communities are causing impacts through herbivory, browsing, horning, or rubbing, then a decrease in the number of ungulates on the landscape could result in beneficial impacts on upland shrub vegetation as plant mortality associated with these uses could decrease. Alternatively, an increase in the number of ungulates in the upland shrub communities as in indirect result of management actions such as hazing or under no action, could result in plant mortality if larger numbers of ungulates use the habitat. However, there would be fewer overall elk and bison on the landscape than there are currently so any increase in individual plant mortality is not expected to lead to community level impacts. Because the potential for either beneficial or adverse impacts associated with elk and bison use and associated management actions in these vegetation communities would be minimal, this topic was dismissed from further analysis.

Alpine Zone

The alpine zone is the highest elevation ecosystem at GRSA, which transitions to subalpine forests and meadows below the tree line. There is evidence that elk may seasonally migrate up into subalpine forest and meadows or alpine tundra (CPW 2010; Schoenecker et al. 2006; Zeigenfuss et al. 2011). However, there are currently no known adverse impacts on these vegetation communities in GRSA related to elk habitation and none of the action alternatives are expected to alter this current scenario.

Current and most future proposed fencing configurations 'would preclude bison from using the alpine zone, unless and until bison range is expanded which would hinge on many variables as described in Chapter 2. In fencing scenarios that would allow for bison to migrate into these areas in the future, impacts are unlikely as bison demonstrate a strong multi-seasonal selection for wetland vegetation communities, such as marsh and wet meadow habitats, as well as a strong winter selection for riparian habitats (Schoenecker 2012). In addition, managing bison at a density reflective of what historically occurred in the planning area (based on GRSA's location in the historic continental range of the species and as compared to other DOI managed bison herds) would help balance the effects of bison use in the alpine zone.

Some stakeholders have expressed concerns that there are ongoing issues related to elk in the alpine zone and elk management actions (hazing) could cause elk to re-distribute to this zone. Hazing would occur from late July through December which would limit the potential for impacts to the timeframe when the snowpack is low enough to be accommodating to the elk (presumably late July through late October). Therefore, impacts associated with hazing would be limited to that timeframe.

Under the action alternatives that include elk management only, or coupled with bison in the Park, there is the potential for a seasonal increase in elk usage in the alpine zone that could be

associated with elk hazing. These impacts would be minimal due to the opportunity for public hunting, though potentially constrained by terrain, combined with the employment of management actions such as enclosure fencing. Therefore, this topic was dismissed from further analysis.

Invasive Species

The Federal *Noxious Weed Act* (7 USC 2801-2814, January 3, 1975, as amended 1988 and 1994) provides for the control and management of nonindigenous weeds that injure or have the potential to injure the interests of agriculture and commerce, wildlife resources, or the public health. Nonindigenous plant species known to exist in GRSA include: Russian knapweed (*Acroptilon repens*), cheatgrass (*Bromus tectorum*), whitetop or hoary cress (*Cardaria draba*), Canada thistle (*Cirsium arvense*), bull thistle (*Cirsium vulgare*), field bindweed (*Convolvulus arvensis*), Russian olive (*Elaeagnus angustifolia*), leafy spurge (*Euphorbia esula*), perennial pepperweed (*Lepidium latifolium*), Russian thistle (*Salsola tragus*), and hairy mullein (*Verbascum thapsus*) (Salas et al. 2011). Current management methods to control these nonnative species include mechanical (e.g., mowing, discing, flooding), chemical (herbicide application), and biological (e.g., introduction of host-specific insects).

Ungulate use in areas that are infested with non-native species could result in increasing the number or distribution of invasive plants through the transport of seed in manure or seed that attaches to an animal. Additionally, soil disturbance in an impacted area could allow for increases in invasive species that would compete with desirable native species, particularly in areas of bare ground on the Medano Ranch that have been caused by bison grazing, trampling, and wallowing (Knapp et al. 1999). While bison are present in large numbers, the bare ground is sustained. Once the herd size is reduced substantially, the patches of bare ground could become seed beds for invasive species. Under each of the action alternatives, a reduction in elk and bison density would reduce the number of animals that could distribute seeds of non-native species, as well as the ground disturbances from these animals that could contribute to the spread and establishment of invasive species. However, monitoring and weed control would be required where bare ground is present. This would be true for all action alternatives and the no-action alternative as no bison or bison in lower densities would result in less (or no) disturbances from trampling, punching, and wallowing that would keep vegetation from establishing in those sites.

Impacts from proposed management actions, such as fencing installation or use of horses for hazing, could result in disturbance of currently undisturbed areas which could allow for the establishment or spread of invasive vegetation in these areas. However, Best Management Practices would be used to control the spread of invasive vegetation during proposed management actions. These include, but are not limited to, conducting a site assessment for invasive plant infestations before carrying out field activities to understand what species are present and in what locations, then cleaning soils and plant material from footwear, gear, equipment, and vehicles before entering and leaving the worksite or management area to stop the import or export of seeds, to the extent possible. An additional step to reduce the import of invasive species seeds would be requiring that horses used in hazing activities are fed only certified weed-free hay. Because of these measures of monitoring, ongoing weed control, and

controlling the import and export of invasive species seeds, the issues related to invasive species were dismissed from further analysis.

Water Resources

The Park contains 12 primary streams that flow westward from the Sangre de Cristo Mountains and provide wetlands hydrology. They include Mosca, Medano, Castle, Sawmill, Buck, Little Medano, Cold, Sand, Pole, Deadman, Big Spring, and Little Spring creeks. Of these, the major streams are Medano and Sand creeks. Since there is no surface outlet for groundwater in the northern and eastern San Luis Valley, this hydrological system is a closed basin. The water infiltrates quickly through the sand, adding to the already high permanent groundwater levels in the shallow aquifer under the Park.

Exclosures along Medano Creek that are not accessible to elk and bison have allowed for streambed conditions with narrower deeper channels that are better stabilized by a healthier and more diverse wetland plant community. Reductions in elk and bison densities along Medano Creek would allow for similar conditions for the streambed outside the exclosures and would likely result in better water quality and more stable temperatures which would benefit invertebrates and fish in the streams (Mosher, pers. comm. 2018). Figure 5 depicts the difference between the stream channel inside an exclosure (not impacted by elk and bison) and outside the exclosure in an area heavily utilized by elk and bison.



Figure 5. Medano Creek stream channel inside exclosure (left) and outside the exclosure (right)
Note the narrower channel inside the exclosure

Source: NPS

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Under the no-action alternative, high densities of elk and bison (prior to their removal) would continue to the streambanks and subsequently water quality in the Park due to the demonstrated impact of hoof action in creeks or along the banks of creeks. Soil compaction as a result of hoof action could have an impact on the amount of and location of rainwater distribution as compaction removes air pockets, thereby limiting absorption and retention and increasing runoff and streamflow. The overconcentration of ungulates near creeks and streams could cause increased nutrient loading from manure/droppings and increased erosion from loss of vegetation cover associated with browsing and trampling. However, while there are currently no known adverse impacts on water resources related to nutrient loading from ungulates, Figure 6 depicts an area along Medano Creek where vegetation has been completely removed and is susceptible to erosion due to ungulate overuse.



Figure 6. Denuded area along the streambank of Medano Creek

Under the action alternatives, because management actions are expected to reduce elk density in areas of overabundance and bison density would be reduced, there would be less ungulate use along the banks of creeks and lakes which could improve water quality compared to the current scenario. Reducing ungulate uses that result in loss of vegetation would lead to increased vegetative cover and less erosion. A reduction in compaction associated with reduced elk/bison density would also have the potential to improve soil filtration that can reduce stream flow. The complete removal of bison (no action and Alternative 2) or the reduction in the number of bison and redistribution of elk (Alternatives 3 and 4) would result in measureable improvements to the stream channels and, as such, water quality, as demonstrated by conditions within current enclosures. Therefore, this topic was dismissed from further analysis.

Ethnographic Resources

Ethnographic resources (also referred to as traditional cultural properties) are sites, structures, objects, landscapes, and natural resources that communities identify as significant to their way of life. Connections with ethnographic resources were determined in consultation with the Utes, Navajos, Jicarilla Apaches, Keresan Pueblos, Tewa Pueblos, Tiwa Pueblos, and Towa Pueblo of Jemez. Ethnographic resources in and near GRSA are particularly important to Jicarilla Apaches, Navajos, Puebloan, and Ute peoples. They often visit and collect resources as part of

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their cultural heritage. Collected resources may include pinyon nuts, various edible and medicinal plants, and sand for sand paintings. Landscape features that pertain to emergence narratives are considered culturally significant. These features include water resources, Mount Blanca, and areas not disclosed to the public.

Under the action alternatives that propose lethally removing elk from the population to protect other resources, the NPS would seek to find beneficial uses for animals removed from the population (such as donating the meat to tribes) to the extent practicable, which would indirectly provide a benefit to receiving tribes. American Indian groups and individual tribal members would continue to be able to collect resources and visit significant areas of the Park that they have traditionally visited. GRSA would also continue to consult with American Indian Tribes in the future.

Although bison are not currently managed by the NPS, they inhabit the landscape and GRSA is considering whether or not to manage a herd as part of this UMP/EIS. Bison have historically always been an intrinsic part of the cultural landscape and maintaining them would not result in any changes to that landscape or the cultural practices that still occur there. If an alternative is selected where bison are managed by the NPS, the Medano Ranch would become an education center with guided tours and GRSA would work with tribal partners on education programs that focus on the historical and cultural uses/significance of bison. In addition, GRSA would consider a meat donation program, in which GRSA would donate carcasses or meat, or both to local tribes, to the extent possible.

Since there are no pivotal issues related to ethnographic resources, this impact topic was dismissed from detailed analysis.

Soundscales

Management activities proposed under the action alternatives include sharpshooting and the use of aircraft and other motorized equipment. Hazing by helicopter or fixed-wing aircraft could entail up to four flights (two helicopter and two fixed-wing) with flight times ranging from one to two hours, during winter months. Hazing by motorized vehicle, non-lethal gunshots, or noisemakers could occur up to two times per week and last for one to four hours per event, depending on the method, and could occur during any season other than during calving season and while the calves are still very young (late May through early July). Lethal removal actions entailing sharpshooters could occur weekly from late July through December. Non-hazing actions that would affect the soundscape include one annual winter classification flight that would last up to 8 hours.

Each of these actions would introduce noise into the acoustic environment in remote areas of the Park that would undoubtedly disturb the natural sounds and quiet. Previous studies conducted at GRSA (Colorado Department of Public Health and the Environment 1995) indicated that the background sound level averaged less than 45 A-weighted decibels (dBA) 99 percent of the time, less than 40 dBA (the sound of a library) 90 percent of the time, and less than 35 dBA 50 percent of the time. Effects to the background sound levels (ranges include: up to 60 dBA for use of vehicles, 90 dBA for use of aircraft, and 175 dBA for discharging of firearms) would be limited in duration as described, vehicle usage would be confined to certain areas that are not easily accessible to the public, the sound of gunfire would last only for a few

seconds, and the change in decibel level would only be noticeable in proximity to the noise source. As a result, soundscapes has been dismissed from detailed analysis.

Air Quality

The *Clean Air Act* (42 U.S.C. §7401 et seq., 1970) states that the federal land manager has an affirmative responsibility to protect park air quality related values from adverse air pollution impacts. Today, only particulate matter (PM_{2.5} through PM₁₀) is monitored at the Park, and visibility is currently the only air quality resource value known to be affected by pollution. Air pollution from sources outside the Park would continue to be addressed through Clean Air Act authorities and through cooperative efforts between the NPS and other entities.

Ungulate management activities as described under the action alternatives would result in few impacts on air quality and would not result in a measurable increase in local or regional greenhouse gas emissions. Although some activities, such as vehicle and aircraft use, would create small amounts of emissions, these activities would be limited in duration, lasting from several hours per week to several days for weekly hazing activities; and would not have a measurable effect on local or regional air quality. Bison roundup activities could contribute to fugitive dust emissions from hoof action for the few days on a yearly or even less frequent basis during which the roundup occurs. Overall, these temporary sources of emission would not affect visitors' ability to engage in recreational activities or their experience while they are in the park; therefore, air quality, including greenhouse gas emissions, has been dismissed from further analysis.

Visitor Use and Experience

GRSA offers an abundance of diverse recreational opportunities including camping, hiking, interpretive sites, picnic areas, and wildlife viewing areas. Visitor use in the Park is concentrated in the dunefield area, Medano Creek, and the developed area east of the dunes (visitor center, campground, dunes parking lot, picnic area) (NPS 2003). Based on the typical distribution of visitors in GRSA, the abundance, distribution, and movement of bison and elk has limited potential to affect visitor experience and recreational resources as the areas where bison and elk are located are not generally accessed by visitors. Because of this, implementation of the action alternatives, including managing a herd of bison, would not result in a measurable change to visitor use.

Proposed management activities (e.g., sharpshooting, hazing, fencing installation) may require specific areas of GRSA to be temporarily closed to the general public, which could limit visitation and visitor access to some locations in the Park and Preserve, including certain areas of the backcountry, and constrain visitor movement between the Park and Baca NWR. Closures due to the implementation of management actions would not be in areas that are frequented or, in many cases, accessible to the public and would be temporary, lasting from several hours per week to several days depending on the activity. Some fencing could be perceived by visitors as a physical or visual obstruction, or both. Enclosure fencing, however, could result in long-term beneficial impacts on visitor use and experience, as improved habitat conditions could enhance wildlife viewing conditions. Because of logistical and maintenance concerns, the use of electric

fencing would be avoided, but may be necessary in certain situations. Electric fencing would be designed to avoid inadvertent injuries to visitors, but could be perceived as a minor access and safety concern.

Under the action alternatives that include park management of bison and the Medano Ranch becoming an education center, educational opportunities associated with bison conservation and management would increase, as well as access to the bison herd for park visitors. This would have a beneficial impact on visitor use and experience through increased opportunities for education, interpretation, and viewing bison. Because both the beneficial and real or perceived adverse effects of fencing on visitor experience would be minimal, this topic was dismissed from further analysis.

Socioeconomics

Socioeconomics is the social science of how economic activity affects social processes. The action alternatives could benefit the local economy if hunting opportunities increased because of management activities that redistribute elk outside of the Park and into areas where they can be legally hunted. Currently, private cow elk and bull elk hunts are conducted through an outfitter on the Medano Ranch. These hunts resulted in the harvest of an average of 18 elk (average of 7 cows and 11 bulls) between 2015 and 2017. If/when NPS acquires the Medano Ranch, these activities would no longer be permitted within the Park boundary. This would have a minor negative cumulative impact on socioeconomics from the loss of income to the outfitter as well as if the number of hunters coming to the area decreased. It is unknown if this decrease in hunting opportunities could be offset by the increase in hunting opportunities resulting from NPS management actions and/or potential increases in hunting opportunities on the adjacent Baca NWR. Regardless, the overall impact of NPS elk management actions is not expected to have a noticeable effect on the opportunities for hunting around GRSA or the associated social/economic values. Additional impacts on socioeconomic resources, not including crop damage (see “Socioeconomics: Game Damage”), could result from hiring contractors or additional park staff to help implement proposed management actions. Overall, the action alternatives would likely result in beneficial impacts, though minimal, to the local economy and local employment opportunities, and the no-action alternative would not result in any changes to socioeconomic resources (with the exception of crop damage). For these reasons, this topic was dismissed from further analysis.

Environmental Justice

Executive Order 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations” directs federal agencies to assess whether their actions have disproportionately high and adverse human health or environmental effects on minority and low-income populations. None of the actions proposed in the UMP/EIS alternatives would have a disproportionate and adverse impact on minority populations, low income populations or communities. Also, under the action alternatives that propose lethally removing elk or bison from the population to protect other resources, the NPS would seek to find beneficial uses for animals removed from the population (such as donating the meat to local

Chapter 1: Purpose of and Need for Action

charitable organizations) to the extent practicable, which would indirectly provide a benefit to low-income populations. Therefore, environmental justice was dismissed from detailed analysis.

Indian Trust Resources

National Park Service planning must explicitly consider effects of its actions on Indian trust resources, including Indian sacred sites (512 DM 2). The federal Indian trust responsibility is a legally enforceable fiduciary obligation on the part of the United States to protect tribal lands, assets, resources, and treaty rights, and it represents a duty to carry out the mandates of federal law with respect to American Indian and Alaska Native tribes. There are no Indian trust lands, assets, resources, or treaty rights associated with GRSA. This impact topic was therefore dismissed from detailed analysis (ECM 97-2: Departmental Responsibilities for Indian Trust Resources and Indian Sacred Sites on Federal Lands, Part 1).

CHAPTER 2: Alternatives



CHAPTER 2: ALTERNATIVES

INTRODUCTION AND OVERVIEW OF THE ALTERNATIVES

The National Environmental Policy Act requires federal agencies to explore a range of alternatives and analyze impacts that any reasonable alternatives could have on the human environment. The alternatives under consideration must include a “no-action” alternative, as prescribed by NEPA regulations in 40 Code of Federal Regulations (CFR) 1502.14. The analysis of the no-action alternative “provides a benchmark for a decision maker to compare what would happen to the environment if current management were to continue, versus what would happen to the environment if one of the action alternatives were selected for implementation (NPS 2015b).” Alternative 1 in the GRSA, UMP/EIS is considered to be the “no-action” alternative, which would include continuation of current elk and bison management per the 2007 GMP Record of Decision.

In addition, an interdisciplinary NPS team considered input from a science team convened for this plan, cooperating agencies, and the public to refine a range of preliminary alternatives during the scoping phase of this project. Ultimately, three “action” alternatives were considered reasonable in that they meet the purpose and need and are technically and economically feasible. As described in Chapter 1, while there is sufficient information to characterize and analyze management tools to address elk overconcentration issues, there are limitations in available data and uncertainties regarding the timing, location, and environmental impacts of potential bison management. As a result, the action alternatives described in this chapter provide specifics regarding the implementation of potential elk management tools, but take a broader, higher level “programmatically” look at potential options for the future of bison at GRSA, such as 1) whether or not to amend the GMP to allow for bison in the Park, and if so, how many bison might be appropriate; 2) when the NPS would assume bison management responsibilities; and 3) what management tools the NPS might use upon assuming bison management responsibilities. The NPS would conduct additional planning and compliance, as needed to address the implementation details of managing a bison herd. Any future planning and compliance would be tiered from this UMP/EIS.

Due to limitations in available data and uncertainties regarding impacts, this chapter also describes an adaptive approach that would be taken for ungulate management (see “Adaptive Management” section). In addition to uncertainty around bison management options and tools, there is also uncertainty in how those may affect elk distribution and abundance and ultimately, elk management options and tools. These uncertainties would be best addressed through monitoring and adaptive management. The goal of monitoring and adaptive management would be to use the most relevant indicators and quantitative ecological metrics to inform whether or not elk redistribution and bison management efforts are producing the desired trends in ecological integrity; or if there is a need to manage the overall elk population density and abundance in the Park, and/or adjust bison density and abundance ranges.

The following is a summary of the four alternatives analyzed in detail in this UMP/EIS. In addition, the interdisciplinary team evaluated other actions or alternatives identified through scoping that were ultimately eliminated from further consideration. These actions and

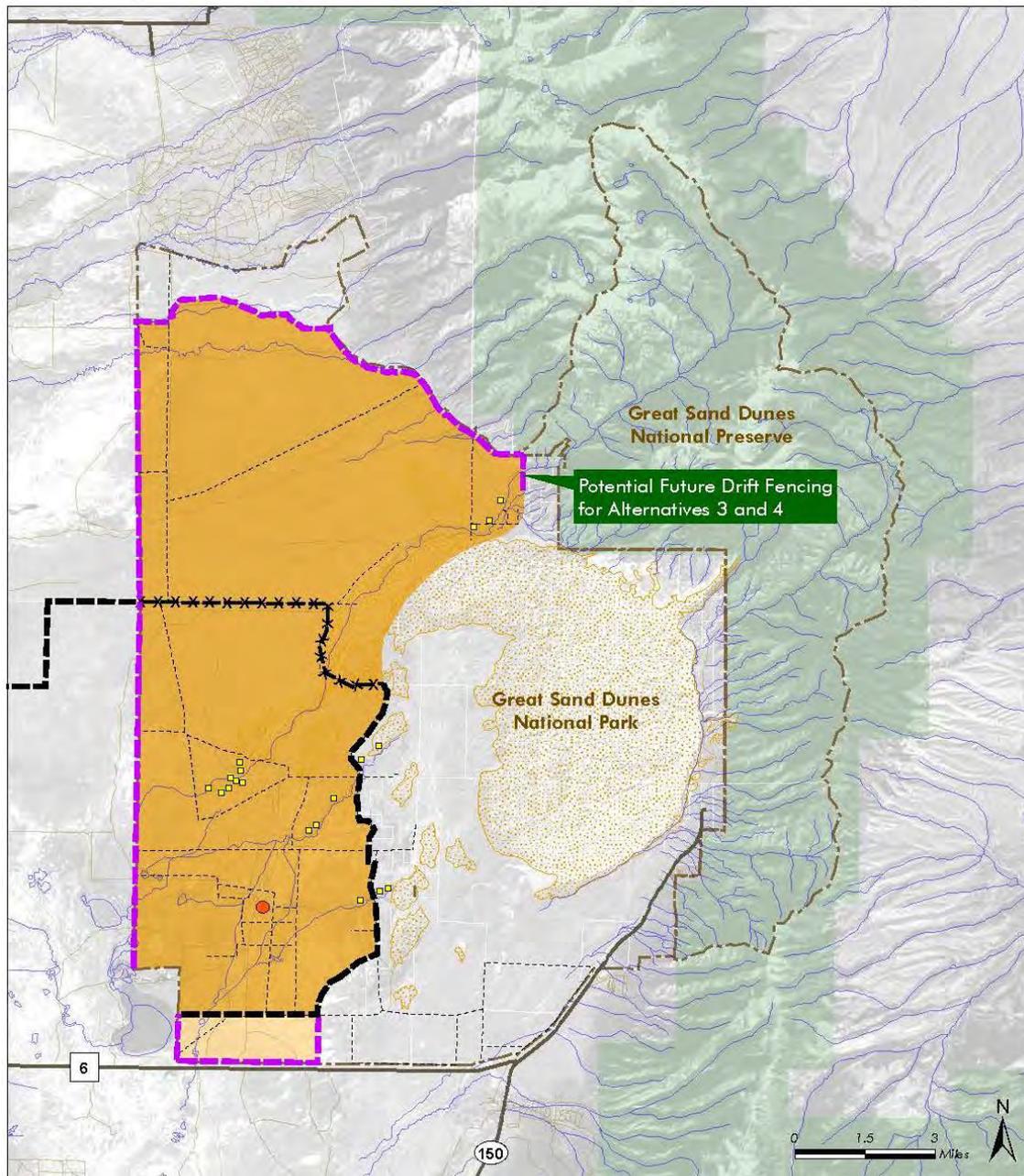
alternatives are also discussed in this chapter (see “Alternatives Considered but Dismissed from Detailed Analysis”).

Alternative 1 — Existing management would continue under Alternative 1 according to the 2007 GMP Record of Decision. Under this alternative, there would be no active elk management, and no new action would occur to manage impacts from elk, including the effects of elk herbivory. TNC would continue to graze bison on the Medano Ranch until government acquisition and would be responsible for removing their bison and associated fencing prior to NPS acquisition of the Medano Ranch. The NPS would remove the current bison fencing on NPS lands.

Alternative 2 — Alternative 2 would incorporate active elk management to redistribute elk from areas of overconcentration. Active elk management actions would include non-lethal elk dispersal tools, such as hazing, and lethal removal for dispersal. Additional exclosures (fencing) would be constructed for the purpose of habitat restoration as determined through monitoring. This alternative would follow the current direction in the GMP for bison, as described for Alternative 1.

Alternative 3 — Alternative 3 would include the same non-lethal and lethal elk redistribution tools and management actions described under Alternative 2. Under this alternative, the NPS would amend the GMP and partner with another entity to continue to manage for 5–7 years following NPS acquisition of the Medano Ranch. After this timeframe, the NPS would assume responsibility of bison management within the recommended density range (i.e., a lower density). Bison would initially be managed on NPS land in the existing bison fence, yet the bison range could be expanded within the life of the plan (Figure 7). Tools that could be used to manage bison abundance and distribution in the future would include roundup and translocation, hazing, and lethal removal for dispersal.

Alternative 4 — Elk management under this alternative would include the same non-lethal and lethal management tools and actions described under Alternatives 2 and 3. Under this alternative, the NPS would acquire the Medano Ranch with no bison, but would amend the GMP so that after a period of 5–7 years, the NPS would establish a new conservation herd to be managed within the recommended density. Tools that could be used to manage bison abundance and distribution in the future would include roundup and translocation, hazing, and lethal removal for dispersal.



Great Sand Dunes National Park and Preserve Ungulate Management Plan

- | | |
|--|---|
| — Existing TNC Bison Fence | ■ Alternatives 3 and 4 Expanded Bison Range |
| — Bison Fence Proposed for Alternatives 3 and 4 | ■ Potential Future Bison Expansion |
| X X X Fence Section removed for Alternatives 2, 3, and 4 | — National Park Service Boundary |
| ----- Existing Fencing within Park Boundary | ■ Dune Field |
| ● TNC Bison Handling Facility | |
| ■ USGS Enclosure Site | |

Figure 7. Fencing, enclosures, and infrastructure

ELEMENTS COMMON TO ALL ALTERNATIVES

The following actions would be common to all alternatives, including Alternative 1, which would continue current management.

Public Hunting in the Preserve

Elk hunting, per NPS policies, CPW objectives, and state regulations, would continue to occur in the Preserve during the elk hunting season, but would not be allowed in the Park.

Research

In GRSA, several (18) exclosures that were established for research purposes (Figures 7 and 8) would continue to be maintained as long as needed for research purposes. Research conducted in a number of these plots contributed to the knowledge of the effects that ungulate herbivory has on park vegetation (such as riparian and wet meadow communities). Although these research exclosures would be common to all alternatives, they were not constructed for management purposes. Under all alternatives, these exclosures would continue to be used as appropriate for adaptive management and research.



Figure 8. Research exclosure in a cottonwood stand
Source: NPS

Ecological Monitoring and Data Collection

The Rocky Mountain Inventory & Monitoring Network (ROMN) initiated wetland monitoring in GRSA in 2010 and furthered these efforts under the auspices of a peer-reviewed Wetland Ecological Integrity (WEI) Monitoring Protocol for GRSA and three other parks in the network (Schweiger et al. 2015). The goals for long-term ecological monitoring of ROMN wetlands focus on documenting the status and trend in wetland condition, understanding the causes of change in wetland condition, and assisting in the application of WEI results and relevant auxiliary information to park wetland management. Figure 9 depicts the establishment of a wetland monitoring site in the Park in 2010.

The ROMN protocol monitors wetland ecological integrity or health by monitoring wetland vegetation communities and their important drivers including groundwater hydrology, soils, natural disturbance (including the general level of ungulate use), and human disturbance (including groundwater diversion and other modifications and uses). ROMN monitoring includes Park-wide “surveys” of wetland health every 10 years and annual monitoring at five “sentinel” wetland complexes (three in the Park and two in the Preserve, each with 5—10 plots). ROMN annual monitoring includes continuously logging groundwater hydrology at sentinel sites as well as evaluating wetland condition relative to other important drivers such as weather and climate.



Figure 9. Establishing a wetland monitoring site at GRSA in 2010
Source: NPS

ROMN recently began “enhanced” wetland monitoring in GRSA to complement anticipated adaptive management and monitoring efforts by GRSA and its partners, specifically to better understand and differentiate the relationship between elk and bison use and management as they impact wetlands in the Park. Monitoring enhancements include better documenting the type and level of ungulate use at monitoring sites, increasing the number of sites and increasing the frequency of monitoring at some site (including continuously monitoring shallow groundwater at 10 sites in the Park). In 2017, ROMN and its partners conducted 46 monitoring events in the Park (in contrast, in 2015, ROMN conducted 26 “un-enhanced” wetland monitoring events). Under budget scenarios and management needs as of 2018, the NPS expects to conduct and report on Park-scale wetland surveys in GRSA every 5 years.

ROMN recently published an analysis of the first park-wide survey of wetlands in 2010 (Schweiger et al. 2017). The network modeled vegetation metrics, environmental covariates, and ungulate use to measure overall ecological integrity. By evaluating wetland health in the

Chapter 2: Alternatives

Park relative to ungulate use, the authors concluded that roughly 32 percent of the “salty meadow” wetland (comprised of salt flat and wet meadow wetland vegetation communities) was in a non-reference (degraded) condition while about 38 percent was in reference (good) condition and around 7 percent in a near pristine state. The remainder (around 23 percent) was in an intermediate condition. Under this EIS, the ROMN will work with the Park and its partners to incorporate benchmarks (assessment points) and the appropriate monitoring intervals to document whether ungulate management activities (along with other important drivers of wetland health such as hydrology and climate) are achieving desired wetland conditions. For example, assessment points might include percentages of wetlands in reference condition and/or trends toward improving condition.

Coordination with Other Agencies

Communication with other agencies and the public would be a key component of all alternatives. Park staff would continue to work with park neighbors, public and private, to achieve the purposes of GRSA and to protect fundamental resources and values. Specifically, GRSA would continue to coordinate with other agencies involved in elk and wildlife management (e.g., CPW, USFWS, USFS, U.S. Geological Survey [USGS], TNC, county and local governments) on the implementation of ungulate management efforts. This coordination currently includes sharing study results and data on vegetation monitoring and elk densities, as well as results of removal efforts on adjacent lands. Development of future implementation plans that tier to this EIS would engage partners in a cooperator and/or advisory capacity, as appropriate.

Education

Educational and interpretive activities would be used to inform the public about ungulate ecology and associated park resource issues. This could include new or expanded exhibits and signage, as well as print and digital media products. Per the 2007 GMP and Record of Decision, when the Medano Ranch comes under NPS management, the NPS would seek partnerships to maintain structures and provide scheduled visitor activities and educational opportunities at the Medano Ranch headquarters.

ALTERNATIVE 1

Alternative 1 is the no-action alternative and would involve the continuation of current management of elk and vegetation in GRSA.

Elk Management

While elk hunting in the Preserve would continue under this alternative, the NPS would not take any management actions to redistribute elk from areas of overconcentration in the Park.

Bison Management

TNC would continue to graze bison as a livestock herd on the Medano Ranch until government acquisition. The NPS would acquire the Medano Ranch with no TNC bison, and all existing TNC bison fencing on NPS lands (see Figure 3) would be removed.

Vegetation Management

Under this alternative, no measures would be employed to maintain or restore areas used by elk other than existing exclosures that were established for research purposes (Figures 8 and 9), which would continue to be maintained as long as needed for research purposes.

ELEMENTS COMMON TO ALL ACTION ALTERNATIVES (ALTERNATIVES 2, 3, AND 4)

The actions described under “Elements Common to All Alternatives” section of this chapter would continue under all the action alternatives. Additional actions that would be included under all action alternatives or under only those alternatives that include bison management (Alternatives 3 and 4), are described in the sections below. Note that all actions in proposed wilderness involving prohibited uses under the Wilderness Act would be subject to a minimum requirements analysis before being implemented.

Active Elk Management

Under all action alternatives, the NPS would use a variety of tools to manage the distribution of the elk population in the Park. The elk population would not be managed solely based on numbers in the Park, but rather in such a way as to ensure desired habitat conditions in the Park are met as well as to support NPS and CPW goals for elk management. For the NPS, these goals include reducing the percentage of elk utilizing the Park as winter range (the period from 1 December to 15 April). As described in Chapter 1, the land area managed by the NPS is approximately 20 percent of the winter range, and it would be expected that approximately 20 percent of the wintering elk population might use these lands if all winter range was of equal quality. Given GRSA currently supports an average of 75 percent of the wintering elk population, it is unlikely the NPS would be able to reduce that to approximately 20 percent during the life of this plan, or, since all winter range is not of equal quality, if that percentage is even appropriate. Based on this, the NPS goal is to reduce wintering elk population to 40 percent of the total DAU elk population.

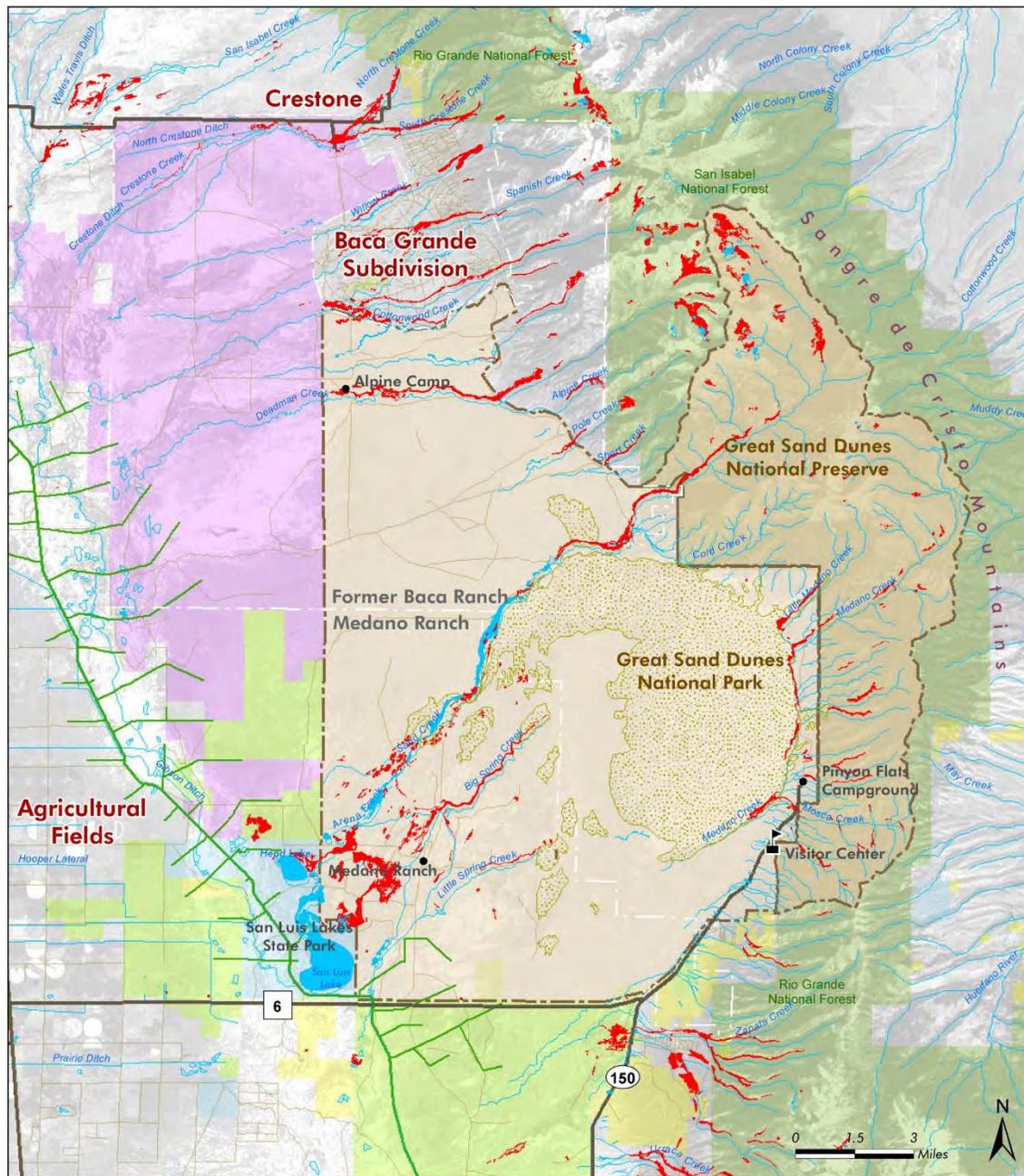
Elk management would be focused on distributing elk across the landscape in order to reduce impacts on sensitive resources, particularly wetland vegetation. The following tools would be used under all action alternatives to manage the elk population in the Park. As appropriate, use of these proposed management tools in areas managed as wilderness would be subject to a minimum requirements analysis to determine if they are the minimum tool necessary.

Lethal Removal as a Tool for Dispersal. Under all action alternatives, lethal removal could be used throughout the Park in combination with non-lethal hazing to disperse elk to manage their

distribution and density. The best information available, including applied experience by staff at the Baca NWR, suggests that there are limits to the effectiveness of non-lethal tools alone in moving the targeted number of elk to the desired location. Given their propensity for wetland vegetation communities, these actions would seek to move elk to non-wetland areas in the Preserve or other public lands (see Figure 10). Lethal removal would be used predominantly during hunting seasons. The goal of lethal removal is to move elk to locations outside the Park where they can be legally harvested by licensed hunters via state sanctioned hunts, and thus, reducing the numbers that would need to be killed per year in the Park. Based on available information in other locations in the region, redistribution success could require killing between two and ten elk per day for three weeks to a month at a time to move the herd off of a particular area. Without this constant pressure, elk could quickly reoccupy the area from where they are being dispersed (Basagoitia, pers. comm. 2017). As such, this plan assumes culling between ten and 50 animals per week up to a total of four weeks (or a range of 40–200 elk). These numbers are not intended to be prescriptive, but are presented for the sake of analyzing the potential intensity of management actions and related impacts. Actual numbers of elk to be lethally removed would be evaluated annually in collaboration with partners such as the USFWS and CPW, taking into account redistribution goals, including those described above regarding percentage of the wintering elk population in the park, as well as those described below regarding movement of elk.

Lethal removal could occur from late July through late December. Additional lethal removal actions could occur during later months but would be prescribed in consideration of animal welfare, similar as described in the following section, “Non-lethal Hazing as a Tool for Dispersal.” National Park Service staff, authorized agents, and trained volunteers would work simultaneously in different areas throughout the Park, which would be determined during a pre-dispersal meeting, and would generally access an area on foot or horseback, or by vehicle (e.g., off-road vehicles, trucks), as appropriate. Personnel engaged in these operations would be required to complete NPS range qualifications, and efforts would be made to deliver lethal shots to targeted animals. Consideration would be given to the choice of firearm, ammunition (e.g., non-lead/non-toxic), and shot placement to ensure the humaneness of the action. Each lethal removal team would consist of a qualified NPS employee as a team lead and up to four other team members (e.g., authorized agents and skilled volunteers). Using radio collar data, the teams would mobilize to the focus area using the appropriate travel method for accessing the area. For the sake of analysis, lethal removal operations would entail up to five individuals travelling in two vehicles on established roadways (including two-track roads) and then entering the focus area on foot or accessing the site on horseback; however, it is possible that management activities would require vehicles to travel off existing travel routes. The teams would be responsible for the culling activities as well as carcass processing and removal.

Lethal removal actions would start at the low end during the first month of implementation and elk movement would be monitored to determine redistribution success.



Great Sand Dunes National Park and Preserve Ungulate Management Plan

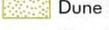
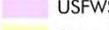
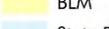
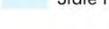
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|--|--|---|
|  Water |  National Park Service Boundary |  USFS |
|  Wetland |  Great Sand Dunes National Park |  Land Trust |
|  Dune Field |  Great Sand Dunes National Preserve |  USFWS |
|  Canal | |  BLM |
| | |  State Parks |



Figure 10. Sensitive vegetation in relation to residential and agricultural lands

Based on input from regional land and wildlife managers, successful redistribution could mean moving the herd up to five miles away (Basagoitia, pers. comm. 2017).

Redistribution efforts would be focused on moving the Park towards the desired conditions described in Chapter 1. If the efforts described above prove to be unsuccessful then the NPS would work with various entities (FWS, CPW) to implement the adaptive management approach and potentially increase the culling objectives. Continued monitoring of both the elk herd and vegetation conditions would be needed to inform development of a new culling objective.

Non-lethal Hazing as a Tool for Dispersal. While limited in effectiveness as stand-alone tools, under all action alternatives, a variety of non-lethal hazing methods (hazing by horseback, motorized vehicle, shooting non-lethal rounds, and noisemaking) could be used in combination with lethal removal to enhance elk dispersal from areas of overconcentration.

Hazing would be conducted starting in late July and going through late December when elk are concentrated in the Park, and would be adjusted, as needed, based on effectiveness as describe above under “Lethal Removal as a Tool for Dispersal.” Generally, hazing would not be used during calving season and while the calves are still very young (late May through early July) or during severe winter (January through March) to minimize animal welfare issues and reduce stress and adverse impacts to the animals. As with lethal removal, non-lethal hazing would seek to move elk to areas where the elk could be legally harvested during hunting season. Such activities would be coordinated with USFWS and CPW who manage hunting on adjacent lands. If non-lethal hazing is conducted outside of hunting season, hazing efforts would focus on moving the elk to the Preserve or areas on adjacent public lands where the concentrations are lower. Likewise as with lethal removal, non-lethal hazing efforts would cease immediately should it result in elk moving to undesired locations.

For the sake of the analysis, it was assumed that non-lethal hazing could include the utilization of the following tools: hazing by horseback, motorized vehicle, shooting non-lethal rounds, and noisemaking and that non-lethal hazing would occur up to twice per week. The tools and frequency would be adjusted to either increasing or decreasing, as needed, based on effectiveness.

A description of non-lethal hazing tools is as follows:

- **Hazing by horseback** – NPS staff or authorized agents in a team of up to four individuals on four horses would deploy to an area where elk are to be moved and drive the herd in the direction they need to be moved. Horses would be fed weed-free hay for a minimum of three days prior to being brought to the Park, in order to minimize the spread of invasive plants. Hazing by horseback could occur up to two times per week and last between two and four hours per event
- **Hazing by motorized vehicle (truck, off-road vehicle, or both)** – Personnel on up to four off-road vehicles or trucks would drive in the vicinity of the herd and attempt to move the elk to desired areas. Vehicles would travel on existing roads and existing two-track roads to the extent possible; however, it is possible that management activities would require vehicles to travel off existing travel routes. In general, vehicles would avoid driving off of two-track roads in wetland vegetation communities. Vehicles would be pre-washed prior to entry into the Park in an effort to minimize the spread of invasive plants.

Hazing by motorized vehicle could occur up to two times per week and last for one to two hours per event.

- **Hazing by shooting with non-lethal rounds** – Up to five personnel strategically placed throughout the herd would shoot non-lethal rounds in the vicinity of the herd in order to move them in the desired direction. Hazing with non-lethal rounds is typically only effective for a short time (less than one week) and may only affect a small group of elk. Hazing by shooting with non-lethal rounds could occur up to two times per week and last for one to two hours per event.
- **Noisemaking** – Up to five personnel strategically placed throughout the herd would use firecrackers, sonic propane cannons, or similar noisemaking devices in the vicinity of the herd, in order to move them in the desired direction. Hazing by noisemakers is typically only effective for a short time for small group of elk. Hazing by noisemaking could occur up to two times per week and last for one to two hours per event.
- **Hazing by helicopter or fixed-wing aircraft** – A helicopter or fixed-wing aircraft would drive elk to desired areas. Aerial hazing is particularly useful during winter months, when ground access to certain areas of the Park is limited because of snowpack. Hazing by helicopter or fixed-wing aircraft would occur utilizing one aircraft up to twice per winter each (for a total of four possible flights) with flight times ranging from one to two hours. Aerial hazing would be coordinated with CPW and any state regulations or policy regarding hazing during hunting seasons would be considered.

Exclosure Fencing

Existing exclosure fencing would be maintained and new exclosures would be constructed, if needed, to allow for habitat restoration or protection of sensitive species in specific locations. Exclosures would be designed following CPW guidelines (Hanophy 2009) to preclude access of elk or bison, or both but to allow for maximum ingress/egress for other wildlife, and avoid effects on migration. The size and location of specific exclosures would be determined during implementation and informed by ROMN WEI monitoring, but for planning and analysis purposes the size of all exclosures combined were assumed to cover no more than 500 acres in wetland vegetation communities. Based on actual conditions on the ground, as identified through monitoring and surveys of fencelines, the amount of and alignment of any fencing needed may need to be adjusted in the future to achieve vegetation management objectives.

Adaptive Management

Because the range of alternatives includes the removal of bison completely or deferred NPS management of bison for 5–7 years, and because of concerns that the high concentration of elk could be resulting in impacts on certain park resources such as wetland vegetation communities, the initial phase of this plan would focus on managing elk to alter their high concentrations at certain times in the Park. Over the long term, the NPS would develop quantitative metrics of ecological integrity and vegetative condition as additional triggers to adaptively manage elk and, possibly, bison. Therefore, for the purpose of this plan, adaptive

management is divided into two phases: initial management and long-term adaptive management.

Initial Management Phase. The initial management phase would focus on altering the high concentrations and large group sizes of elk that currently exist in the Park, as described in Chapter 1. The preferred alternative includes lethal and non-lethal dispersal tools to affect the distribution of elk in GRSA. These actions would be coordinated by season and geography to maximize effectiveness of both tools and could be used concurrently, as appropriate. The NPS would coordinate these activities occurring inside the Park with hunting outside the Park in an attempt to support NPS and CPW goals for elk management (see “Active Elk Management” subsection). As described previously, the NPS seeks to reduce wintering elk population to 40 percent of the total DAU elk population as an initial goal for meeting desired conditions. In addition to the overall reduction of elk wintering on the Park, the following metrics could also be considered: a reduction in group size based on aerial and ground surveys during the wintering period and an evaluation of impacts of reducing numbers and group size on adjacent winter range including private lands and USFWS NWR lands. The NPS would work with adjacent land managers to determine impacts on game damage and wetland vegetation on adjacent lands. As described below, once quantitative metrics for wetland and vegetative conditions are developed, they would be used as thresholds for determining the amount of redistribution needed

Long-term Adaptive Management. NPS elk management goals would be adjusted based on the ability of the NPS to meet desired conditions, as identified through monitoring efforts, and taking into account CPW goals for elk management outside of the park. While there have been numerous research and monitoring efforts that suggest ungulate use is heavily impacting wetland vegetation communities in the Park, none of these have quantitatively linked ecological conditions and vegetation responses specifically to elk versus bison use (Schoenecker 2012; Schoenecker et al. 2006, 2015; Wockner et al. 2015, Zeigenfuss and Schoenecker 2015). ROMN wetland monitoring has demonstrated a decrease in wetland ecological integrity at higher levels of general ungulate use (Schweiger et al. 2017). There are many important factors impacting vegetation communities (besides ungulate use), especially groundwater hydrological patterns (across the park and through time). Other potential confounding factors are soil characteristics, landscape position (e.g. distance to human disturbance such as an impoundment or road), wetland patch size, and climate. Current enhanced wetland monitoring by ROMN and CNHP is attempting to account for these confounding factors and differentiate vegetation community responses to elk versus bison.

Through the long-term management of elk and, if appropriate, bison, the NPS would seek to support a historical array of ecologically healthy plant communities across the Park’s landscape that are used by these ungulates, specifically wetland vegetation communities. Because the Park wetlands coevolved with bison and elk use over thousands of years, some level of native ungulate use is likely necessary for ecologically healthy wetland communities (Schweiger et al. 2017). Therefore, long-term management of elk (and bison, if appropriate) would seek to achieve an appropriate range of ungulate use in wetlands that is representative of the historical usage versus the current levels that have resulted in concentrations of elk that are having negative impacts on wetland vegetation communities (Schweiger et al. 2017). The goal of this long-term adaptive management framework is to continually evaluate the effectiveness of the ungulate management plan; inform uncertainties; improve management over time; and ensure

that impacts of elk and bison, and their management inside the Park, remain within the range of impacts predicted in Chapter 4 of this UMP/EIS.

To this end, over the first 3 to 5 years after signing a Record of Decision, GRSA would conduct additional fieldwork, use statistical modeling for ecological integrity, analyze the data to determine the most relevant indicators and quantitative ecological and vegetation thresholds, and develop a structured decision making tool for ungulate management. This initial monitoring would also help inform GRSA about the effects of elk (and bison, if applicable) on ecological health of vegetation and refine the monitoring approach. Monitoring during this timeframe will attempt to establish a baseline and initial trends for the influence of elk and bison on ecological health of vegetation communities.

Using data collected over the first 3 to 5 years of implementation, d, GRSA would then identify quantitative ecological and vegetative indicators and thresholds that would guide when additional ungulate management tools identified in this plan would be implemented. This process, which would involve interested stakeholders, would include the following basic steps:

- conduct initial outreach to stakeholders approximately 3 to 4 years after signing a Record of Decision;
- identify adaptive management indicators and thresholds within approximately 5 years of signing a Record of Decision; and
- analyze monitoring results annually to:
 - adjust ungulate management, as needed, to meet goals and objectives of the plan; and
 - assess need for changes in monitoring metrics or alterations to the way resources are monitored.

As described above, groundwater availability, hydrology, among other confounding factors strongly influence the extent and health of all plant communities in the semi-arid San Luis Valley. Therefore, the goal of monitoring would be to help inform if elk redistribution efforts have been successful in dispersing the overall elk population density and abundance in the Park and thus progressing towards desired trends in ecological integrity. If monitoring shows the overall elk population density and abundance in the Park is too high, the NPS would likely use similar tools as described in this UMP/EIS to affect a larger reduction in the number of elk in the Park. Any additional planning and compliance needed to do so would be completed, as appropriate.

In addition, as noted under Alternatives 3 and 4 of this chapter, the NPS would ultimately manage bison within a density and abundance range of 0.001 and 0.01 bison per acre to reflect GRSA's contribution in the historic continental range of the species. Data collected during initial management would be coupled with longer-term data to adjust, if necessary, bison density and abundance ranges so they support the desired conditions related to ungulate management.

Finally, as monitoring progresses over the life of the plan, the monitoring methods themselves, as well as any associated indicators and thresholds, may be adjusted to focus on measures that provide the best information on ecological and vegetation response to ungulate use.

Elk Distribution Monitoring and Data Collection

Redistribution success would include movement of the elk from the areas of overconcentration as well as consideration to whether or not the elk are redistributing to desired locations. If elk quickly reoccupy the areas where redistribution efforts were focused then the intensity of lethal removal actions would increase. If elk redistribute to undesirable areas, which includes neighboring agricultural lands, particularly in DAU E-55 where the population objective for elk is zero (Figures 2 and 10), and other adjacent public and private lands where hunting is not permitted, then redistribution efforts would cease immediately and NPS would coordinate with partner entities to correct the situation. Redistribution actions would be coordinated with the USFWS and CPW in an effort to increase opportunities for hunter harvest outside of the Park.

Redistribution effectiveness would be measured through a combination of ecological monitoring (see previous section “Ecological Monitoring and Data Collection”) and elk distribution monitoring and data collection. Monitoring of elk distribution would occur through outside research, cooperation with CPW, and by the NPS as funding becomes available, and could include the following:

- annual winter classification flights as a measurement of elk redistribution success with each flight lasting approximately 6 to 8 hours;
- installation of stationary cameras and conducting scat and track counts in areas of overconcentration;
- use of radio-telemetry collars and/or standardized on the ground counts of the elk populations during all seasons, as needed, to measure elk redistribution success; and/or
- use of remote monitoring techniques.

Elk monitoring data collected from radio collars would be studied to determine if hazing has been effective. Review of these data would inform how many elk were dispersed, where they dispersed to, and if or when they returned. As previously noted, successful redistribution could mean moving the herd up to five miles away. Continued monitoring of both the elk herd and vegetation conditions would be used to determine if redistribution by non-lethal hazing was successful as well as how and when to focus non-lethal hazing tools. Collaborating on monitoring and collecting monitoring data for inclusion into the adaptive management framework will be a key area of cooperation with partners, particularly CPW.

Agency Coordination

Great Sand Dunes National Park and Preserve would coordinate active elk management actions with neighboring agencies, including USFWS, USFS, and CPW. In coordination with agency cooperators, Park staff would develop an annual operations plan to identify data sharing relationships, the sequencing of tools and how many animals would be removed each year, and to ensure proper training, certification, and safety of personnel. These efforts would assist in ensuring that implementation of management actions would be complementary to neighboring agency actions rather than counterproductive. Actions to redistribute elk would be done in a manner that allows for increased legal harvest on lands where such harvest is allowed and at rates commensurate with CPW herd objectives. Additionally, coordination with other

neighboring agencies would be conducted such that attempts to re-distribute elk would not exacerbate crop damage on adjacent agricultural lands (Figure 10) that could occur if elk hazing unintentionally moved elk onto these lands, rather than the desired direction.

Disease Management and Testing

Any elk or bison killed as a result of any management action would be tested for species-specific wildlife diseases (e.g., Chronic Wasting Disease [CWD] for elk) and other potential wildlife diseases as needed based on protocols established by the NPS Biological Resource Division Wildlife Health Group. Any bison transported out of state or killed as a result of any management action would also be tested, as needed, based on protocols established by the Biological Resource Division Wildlife Health Group and in compliance with the receiving state's animal health requirements. All bison six months of age or older transported into Colorado would be required to have passed a negative test for brucellosis not more than 30 days prior to entry into the state (8 CCR 1201-1.3.03).

Use of Authorized Agents and Trained Volunteers for Specific Actions

Under each of the action alternatives, the NPS would solicit the help of authorized agents and trained volunteers (including tribal members) to assist in management actions, including lethal removal of elk and bison. Authorized agents include, but are not limited to, other agency personnel and contractors. Great Sand Dunes National Park and Preserve would likely solicit and select qualified volunteers through an official volunteer program. To be qualified, all volunteers would need to meet a number of predetermined requirements, including a demonstrated level of firearm proficiency and knowledge of public safety and protection policies established by GRSA in collaboration with the CPW before assisting with lethal removal actions. Compliance with all relevant NPS directives related to firearm use in parks, as well as federal firearm laws administered by the Bureau of Alcohol, Tobacco, Firearms, and Explosives would be required. Great Sand Dunes National Park and Preserve would develop specific guidelines for firearm use, including use of non-toxic ammunition.

Carcass Handling and Processing

Elk and bison that are lethally removed would need to be handled and processed in a manner that would minimize potential exposure to disease as well maximize the amount of an animal that can be donated (see following section "Donation for Consumption or Disposal of Carcasses"). Park staff would ensure appropriate recommendations for field dressing procedures and carcass handling are employed to minimize exposure to possible infectious material. Such recommendations can be found in the Colorado Parks and Wildlife brochure: <http://cpw.state.co.us/Documents/Research/CWD/Mandatory-CWD-FAQ-2017.pdf>.

Recovered elk would be taken to the processing area to be hung, skinned, washed, quartered (if not conducted in the field), bagged inventoried, tissue samples collected for CWD testing and

cataloged, and moved to refrigerated storage prior to donation. Volunteers would be involved in all aspects of culling, processing, and tissue sample collection.

Donation for Consumption or Disposal of Carcasses

For elk and bison that are lethally removed, GRSA would donate carcasses and/or meat, to the extent possible, unless carcasses cannot be removed from the field either via horseback or motorized vehicle due to terrain or ground condition constraints. Other elk or bison parts (e.g., hides, heads, horns) would be either donated to tribal partners or federal or state agencies or cooperators for non-monetary uses (e.g., tribal ceremonial uses, public or educational display, research), or they would be left in the field.

The NPS would explore opportunities to work with state agencies involved with donation of wild meat, which could then make the decision to distribute the meat to whomever they choose, including to the individuals that participated in the trained volunteer program or to other people or organizations as they deem appropriate. The park would consult with the NPS Public Health Program, as well as CPW, to ensure meat is handled and stored properly for consumption. All elk carcasses would be tested for wildlife diseases such as CWD as directed by NPS and State veterinarians prior to donation. If any carcasses test positive for disease, they would be disposed of in accordance with federal and state policies.

Capture, Handling, and Care of Elk and Bison

Every effort would be made to minimize the degree of human contact during procedures that require the handling of live elk or bison, such as radio-collaring, monitoring, and disease control (American Veterinary Medical Association 2007).

ALTERNATIVE 2

Under Alternative 2, in addition to the actions described above under “Elements Common to All Alternatives” and “Elements Common to All Action Alternatives,” the NPS would continue to implement the GMP guidance for bison. As a result, TNC bison and associated fencing would be removed prior to NPS acquisition of the Medano Ranch, and current bison fencing on NPS lands would be removed as soon as possible.

ALTERNATIVE 3 (PREFERRED ALTERNATIVE)

Under Alternative 3, in addition to the actions described in the “Elements Common to All Alternatives” and “Elements Common to All Action Alternatives” sections of this chapter, NPS management of “low density” bison herd on the park would be phased in over 5–7 years after NPS acquisition of the Medano Ranch. This would require an amendment to the GMP, and because the details of bison management are generally unknown at this time, this would be a programmatic decision that generally addresses the density, geographic range, and potential bison management tools that may be used.

Bison Management

Under Alternative 3, the NPS would make a programmatic decision to amend the GMP and manage a bison herd in the Park after acquisition of the Medano Ranch. After 5–7 years, the bison herd would be managed by NPS within a density range of 0.001 and 0.01 bison per acre. This would be intended to reflect the extent of periodic bison presence thought to have historically occurred in the planning area based on GRSA's location in the historic continental range of the species and comparing to other DOI managed bison herds (Plumb et al. 2016). Existing bison fencing would remain upon NPS acquisition of the Medano Ranch. It is also possible, depending on whether or not the NPS and USFWS collaborate on a bison research study on the Baca NWR, that the NPS would construct a new bison fence along the western boundary of the Park. Great Sand Dunes National Park and Preserve would also consider expanding bison range in the Park which would require additional fencing (see the following section, "Fencing and Infrastructure").

For the first 5–7 years after acquisition of the Medano Ranch, the NPS would seek to partner with TNC to manage the bison herd. The details of this partnership would be worked out via the land acquisition process, but this EIS assumes TNC would manage bison herd abundance at current levels (approximately 1,700 animals) during this time, and at the end of this time period, a small number of bison (e.g., 25-50) would remain on the landscape, representing the lower end of the density range within the existing bison fence (i.e., 0.001 bison per acre across 26,000 acres). Should NPS not enter into an arrangement with TNC for any reason, the NPS could partner with another entity to manage bison using appropriate agreement mechanisms. After 5–7 years, which is likely to coincide with a transition to the long-term adaptive management phase of the plan (see the "Adaptive Management" section of this chapter), the NPS would assume management of the bison herd. Based on recent discussions regarding bison management in other NPS units (see Plumb et al 2016), the NPS would allow the herd to grow and would ultimately manage no less than 80 animals as the minimum viable population size. Applying the upper limit of the density range noted above to the area in the existing bison fence (i.e., 0.01 bison per acre across 26,000 acres) would translate to NPS management of a herd of 80 to 260 bison in the Park. The initial release of bison would replicate a semi-natural sex and age structure. The sex and age ratios of the herd would be based on International Union for Conservation of Nature (IUCN) recommendations for conservation herds (Gates et al. 2010). The manipulation of sex and age ratios may change during the life of the plan depending on desired outcome of management actions.

Under this alternative, the NPS would consider allowing bison to expand their range to a larger area in the Park, or to adjacent USFWS lands as part of a research study proposed on Baca NWR (USFWS 2015). Applying the upper limit of the density range noted previously to this expanded acreage means the NPS could eventually manage between 80 and 580 bison in the Park (i.e., 0.01 bison per acre across 58,000 acres). Bison would be contained by new fencing, topography, dunefield, and the availability of suitable habitat. Expansion beyond the current bison fence would hinge on many variables, including but not limited to, future funding for construction and maintenance of new fencing, appropriate staffing, and the ability to appropriately monitor outside of the existing fence.

Ultimately, as discussed in the "Adaptive Management" section of this chapter, resource monitoring would inform the level at which bison are managed within this range. If it is

determined that bison population abundance or distribution needs to be managed because thresholds for management are triggered, then the NPS would use roundup and translocation to remove animals. All management actions would be subject to a minimum requirements analysis for actions in wilderness.

Under all cases, bison management would be informed by NPS experience managing bison at other National Parks, following NPS guidelines.

Roundup and Removal. National Park Service staff or authorized agents, or both, would round up (using proposed hazing methods described for active elk management under “Elements Common to All Action Alternatives”) and drive bison to the existing handling facility on the Medano Ranch (Figure 7). This would be completed using a combination of horseback and all-terrain vehicles to move the bison, similar to the methods that are currently used by TNC. From the holding facilities, bison would be translocated to willing recipients outside of GRSA (this could potentially include future agreements with the InterTribal Buffalo Council (ITBC) or other tribal partners wishing to obtain bison for herd enhancement and for spiritual and cultural practices. Bison could also be rounded up and sent to processing facilities if translocation of live bison is not possible.

Roundups could also be used for monitoring and data collection to determine the status and health of the species for the benefit of the herd and the natural resources it relies on. The NPS would seek to minimize human handling of bison, except as needed to manage within the recommended density range, protect other park resources, and manage safety concerns.

At this time, the details regarding the implementation of these management actions, which may not be used by the NPS for at least 5–7 years, are generally unknown. Therefore, the NPS would conduct additional planning and compliance, tiered from this UMP/EIS, to address the implementation details of managing the bison herd prior to completing the transition in management from a partner to the NPS. For the sake of this EIS, frequency of roundups was assumed to be once annually and would occur over a three-day time period.

Bison Monitoring and Data Collection. Additional annual monitoring of the bison population would likely occur concurrently with elk monitoring through outside research, cooperation with CPW, and by the NPS as funding becomes available, and could include the following:

- annual winter classification flights lasting approximately 6 to 8 hours;
- use of radio-telemetry and/or standardized on the ground counts, as needed; and/or
- use of remote monitoring techniques.

Bison Escape Procedures. If bison get outside of the bison fence, the NPS would work with land owners and other agencies, as needed, to move the animal back onto NPS land using hazing or capture techniques. If this action is unsuccessful, or there is potential for wildlife/vehicle conflicts or game damage to adjacent properties, NPS staff would lethally remove the animal and donate the meat, to the extent practicable. Lethal removal would be based on best professional judgment given the circumstances at the time.

Fencing and Infrastructure

Bison Fencing. Although the NPS is making programmatic decisions regarding the density and geographic range of a bison herd in the Park and the potential tools for managing that bison herd, sufficient information exists regarding potential future fencing configurations that these specific decisions can be made through this UMP/EIS, and additional planning and compliance may not be needed.

In the first phase of bison implementation, the existing bison fencing would remain upon NPS acquisition of the Medano Ranch (Figure 7). It is also possible, depending on whether or not the NPS and USFWS collaborate on a bison research study on the Baca NWR, that the NPS would construct approximately 5.8 miles of new bison fence along the western boundary of the Park (see Figure 7).

As noted previously, depending on several variables, the NPS would ultimately consider expanding the bison range to the north, which would require additional containment fencing in the following general locations (see Figure 7):

- entire west park boundary extending just north of Alpine Camp (15.7 miles long)
- northern boundary of the proposed wilderness area (10.1 miles long)
- along the southwest side of Liberty Road from the wilderness boundary to the Preserve boundary (5 miles long)

Under the expanded bison range, the existing bison fence (6.9 miles long) would be removed along the northern Medano Ranch boundary and extended south across Sand Creek to a point north of Big Spring. The east boundary of the expanded bison range would not initially be fenced between Liberty Road and the dunefield, as it was assumed that terrain and habitat limitations (mountains and dunes) would limit the movement of bison to the east. However, GRSA would retain the option to construct a fence in this location if it is warranted given actual bison movement, based on best professional judgement.

Should the NPS seek to expand bison range in the Park, the expanded area would be open to bison only after the NPS has constructed the necessary fencing called for in this UMP/EIS.

Several additional fencing configurations could be constructed if they became necessary for bison management or new opportunities:

- Drift fencing (approximately one mile) could be constructed in the area between Liberty Road and Sand Creek (north of the dunefield) if necessary to discourage the movement of bison to the east. Such fences would be constructed outside of wilderness (see Figure 7).
- New fencing could be constructed to extend the bison area to the south park boundary to facilitate collaboration in bison management with landowners to the south, or to take advantage of additional visitor use opportunities that may arise in the future along or near Lane 6 (see Figure 7).

The placement of any additional bison fencing would not be expected to conflict with elk management actions in the Park as elk movement is not hindered by the bison fencing and elk redistribution actions would be planned and executed taking fence locations into consideration.

Additionally, bison fencing would be designed to follow wildlife-friendly guidelines and be designed to be passable to other wildlife species (Hanophy 2009).

Bison Infrastructure. If/when the NPS acquires the Medano Ranch, existing bison infrastructure (Figures 7 and 11), including various corrals for holding and weaning, barns, and sheds, would remain to support roundups, gather and translocation, and other active bison management actions as deemed necessary.



Figure 11. Existing bison infrastructure on the Medano Ranch
Source: NPS

Education and Coordination

Alternative 3 would provide the public with an opportunity to see bison and learn about bison conservation and management. The Medano Ranch would become an education center with guided tours per the GMP. Great Sand Dunes National Park and Preserve would work with tribal partners on education programs that focus on the historical and cultural uses of bison and the significance of bison to the tribes. Future planning is needed once the Medaon Ranch is acquired to determine the nature of the education center and additional compliance would be conducted at that time, as needed.

ALTERNATIVE 4

Alternative 4 would include all actions described under the ““Elements Common to All Alternatives” and “Elements Common to All Action Alternatives” sections of this chapter. Under Alternative 4, bison would be removed from the landscape prior to NPS acquisition of the Medano Ranch, and after 5–7 years of rest, the NPS would re-establish and manage a "low density" bison herd on the Park. This would require an amendment to the GMP, and because the details of bison management are generally unknown at this time, this would be a programmatic decision that generally addresses the density, geographic range, and potential bison management tools that may be used. Existing bison fencing would remain upon NPS acquisition of the Medano Ranch. It is also possible, depending on whether or not the NPS and USFWS collaborate on a bison research study on the Baca NWR, that the NPS would construct a new bison fence along the western boundary of the park. Great Sand Dunes National Park and Preserve would also consider expanding bison range in the park which would require additional fencing.

Bison Management

Under Alternative 4, the NPS would make a programmatic decision that would result in TNC removing their bison prior to NPS acquisition of the Medano Ranch and, 5–7 years later, re-establishing (from another DOI bison conservation herd) and managing a bison herd using the same tools and within the same density ranges described under Alternative 3 (0.001 and 0.01 bison per acre in the Park). Initially, the NPS would soft release a small number of bison in the existing corrals before releasing them into the existing fence. At this time, the details regarding the implementation of bison management actions, including hazing, roundup and removal, and lethal removal, to manage the population after the initial release are generally unknown. Therefore, the NPS may conduct additional planning and compliance, tiered from this UMP/EIS, within 5–7 years of signing a Record of Decision, to address the implementation details of re-establishing and managing a bison herd. All management actions would be subject to a minimum requirements analysis for actions in wilderness.

Roundup and Removal. Roundup and removal of live bison would be conducted in the same manner under Alternative 4 as described under Alternative 3, once bison are returned to the Park.

Monitoring and Data Collection. Bison monitoring and data collection would be the same under Alternative 4 as described for Alternative 3, once bison are returned to the Park.

Bison Escape Procedures. Procedures for managing escaped bison under Alternative 4 would be the same as described for Alternative 3.

Fencing and Infrastructure

Bison fencing and infrastructure under Alternative 4 would be the same as described under Alternative 3.

Education and Coordination

Education and coordination under Alternative 4 would be the same as described for Alternative 3.

ALTERNATIVES CONSIDERED BUT DISMISSED FROM DETAILED ANALYSIS

Several potential tools for managing the size of elk and bison populations were considered but dismissed from detailed analysis in this UMP/EIS. A number of these tools were dismissed for bison management, others were dismissed for elk management, and some were dismissed for managing population size in either species.

Public Hunting in the National Park

In 1970, Congress passed the *General Authorities Act* and in 1978 the “Redwood Amendment,” which clarified and reiterated that the single purpose of the National Park System *Organic Act* is conservation. While the *Organic Act* gives the Secretary of the Interior the authority to destroy plants or animals for the purposes of preventing detriment to park resources, it does not give the Secretary authority to permit the destruction of animals for recreational purposes. In 1984, after careful consideration of congressional intent with respect to hunting in National Parks, the NPS promulgated a rule that allows public hunting in national park areas only where “specifically mandated by Federal statutory law” (36 CFR 2.2). The NPS reaffirmed this approach in the *NPS Management Policies 2006* (NPS 2006).

During public scoping, some commenters advocated the use of hunting in the Park to help with the management of ungulates. While the Preserve has always been open to hunting, and that would not change under any of the UMP/EIS alternatives, the suggestion to allow public hunting in the Park would be inconsistent with the existing laws, regulations, and policies noted above. These policies would have to be changed to allow hunting in the Park and all other units of the national park system where hunting is not authorized. Therefore, public hunting in the Park has been dismissed from further consideration. In addition, because the Medano Ranch lies within the legislated boundary of the National Park (as established by PL 106-530, The Great Sand Dunes National Park and Preserve Act of 2000), once acquired, hunting would not be authorized in this part of the Park.

Although public hunting and lethal removals using firearms are both used as conservation tools in ungulate management, there are differences between them that must be clarified. Hunting is a recreational activity administered by state wildlife agencies and through licenses. On the other hand, lethal removals considered in this plan are controlled, structured activities used to meet specific management objectives and not as recreational opportunities.

Reduce Overall Elk Population and Abundance in the Park

Throughout this UMP/EIS process, the NPS considered whether or not issues associated with elk at GRSA were related to the overall elk population abundance and density, and whether or not lethal management and/or reproductive control techniques could accomplish this reduction. However, available data suggest the primary issue is not the overall elk population abundance but rather seasonal distribution (Wockner et al. 2015). As a result, the NPS is not currently as concerned with overall elk population numbers or carrying capacity, but rather, as described in Chapter 1, is more concerned about the fact that a disproportionate number of elk spend a disproportionate amount of time in sensitive and highly productive/diverse areas that are showing impacts from ungulate use (Schweiger et al. 2017). Therefore, while the NPS included lethal removals of elk in this UMP/EIS that would result in some population density and abundance reduction, the initial objective of these lethal removals is to redistribute elk, reduce the percentage of the DAU-11 population that winters in the Park, and to monitor resource response to inform long-term adaptive management. In the event that redistribution does not move the NPS towards the desired conditions described in Chapter 1, the NPS would work with various entities (USFWS, CPW) to implement the adaptive management approach and consider increasing elk culling per year to a higher level. However, establishing an overall elk population

abundance goal and a new herd reduction objective for the Park would require additional monitoring of both the elk herd and vegetation conditions, and is considered beyond the scope of this NEPA review. Therefore, an overall reduction of the elk population abundance was dismissed from detailed analysis.

Wolf Reintroduction

While wolves are important components of management of healthy ecosystems where they currently occur in units of the national park system, their reintroduction to GRSA for the purpose of elk and bison management has been considered and dismissed from further consideration because the home range size of a viable population of wolves would exceed the habitat available on GRSA. Because of this it is expected that wolves would rapidly disperse to neighboring lands and the State of Colorado does not support reintroduction of wolves at this time. Colorado Parks and Wildlife Commission Resolution 10-01, adopted January 16, 2016, supports the natural immigration of wolves into Colorado, provided they be allowed to live with “no boundaries”, but opposes the intentional release of any wolves into Colorado.

Wolves would not be an effective tool for maintaining bison density between 0.01 and 0.001 bison per acre, given 1) wolves generally only kill adult bison when there is substantial accumulation and duration of snow pack (Becker et al. 2008), which is not typical in the San Luis Valley; and 2) wolves prefer prey that is easier to kill than bison (Mattioli et al. 2011; White and Garrott 2005) when such prey are available, as is the case at GRSA. Wolf home ranges are very large but very variable (NatureServe 2017), ranging from less than 200 square miles in Minnesota (Fritts and Mech 1981) to more than 3,800 square miles in the Northwest Territories (Walton et al. 2001). Wolf dispersal is also very variable with some individuals dispersing more than 600 miles (Boyd and Pletscher 1999; Jimenez et al. 2017; USFWS 2016). Given the small size of GRSA relative to wolf home range size, wolves would disperse outside of GRSA to adjacent federal, state, and private lands, which could result in impacts on property and other resources over which NPS has no jurisdiction. The presence of wolves could also result in elk moving into agricultural fields, where they are less likely to be pursued by wolves as they tend to avoid areas of human presence and activity. As a result, wolf reintroduction would not be a feasible alternative to implement and has been dismissed from detailed analysis.

Non-lethal Only Elk Management

During scoping, some commenters suggested limiting ungulate management to non-lethal tools only such as hazing, exclosure fencing, round-up and translocation of live animals, and reproductive control. While the NPS has retained the option to use some of the recommended non-lethal elk management tools in combination with lethal tools, the use of non-lethal tools only was considered and dismissed from further consideration. The best information available, including applied experience by staff at the Baca NWR, suggests that there are limits to the effectiveness of non-lethal tools such as hazing where the USFWS has had limited to no success in moving the targeted number of elk to the desired location. Therefore, we would not expect the use of non-lethal tools to be an effective means of meeting the need for redistributing elk in the Park. Dismissal of other non-lethal management tools such as round-up and

translocation of live animals, and reproductive control are discussed in detail in other sections of this chapter.

Reproductive Control in Bison

This alternative would have allowed the use of fertility control agents to manage bison population abundance, either initially or in the long term. However, no chemical fertility control agents have been federally or state approved or registered for bison. While there are two possible products that could be considered (GnRH vaccine and PZP vaccine), Powers and Moresco (2015) state that science about how fertility control affects wildlife ecology (e.g., individual animal and population level outcomes, immigration and emigration patterns, natural selection pressures, resource utilization, behavioral ecology, disease transmission, ungulate physiology, and other aspects of natural life history of the species) is critical to inform management decisions. Both vaccines noted above would affect the animal's immune system, could produce numerous side effects, and would have unknown long-term effects (i.e., return to fertility, likelihood of permanent sterility after multiple doses, duration of multi-year efficacy). Powers and Moresco (2015) also noted that fertility control is least consistent with NPS values if applied to native species residing in lightly disturbed systems and is least feasible in relatively large or open populations. Although the NPS would manage a smaller herd of bison, and there are no other bison populations that interact with bison at GRSA, fertility control techniques often have proved uneconomical or infeasible for practical implementation even in small, localized populations (Fagerstone et al. 2002). And ultimately, the intent of the NPS is to manage bison, which are a native species in the San Luis Valley, as semi free-ranging wildlife on a lightly-disturbed landscape.

Fertility control can also take a long time and require repeated applications to achieve population reduction consistent with objectives, requiring additional expertise and staffing that GRSA currently does not have. Alternatives that consider bison management at GRSA require a substantial reduction in the density and abundance of bison—from the approximately 1,700 bison there today to less than 100 bison—to reflect the numbers expected in this part of their historic range.

Therefore, reproductive control has been dismissed from further consideration because of the potential for additional and unknown environmental effects when compared to other bison management tools, inconsistency with NPS values regarding wildlife management, and because it would be unpredictable in managing bison population abundance.

Reproductive Control in Elk

When available for use, fertility control techniques are applied to manage the size of wildlife population abundance over time. As previously stated, available data suggest the primary issue is not the overall elk population abundance but rather seasonal distribution (Wockner et al. 2015). As a result, the NPS is not currently as concerned with overall elk population numbers or carrying capacity, but rather, as described in Chapter 1, is more concerned about the fact that a disproportionate number of elk spend a disproportionate amount of time in sensitive and highly productive/diverse areas that are showing impacts from ungulate use (Schweiger et al. 2017).

While the alternatives carried forward would result in some reduction in elk abundance, they are primarily intended to alter distribution of elk, which fertility control is not intended to do. Further, immuno-contraception has not been shown to be effective in wild free-ranging cervids due to the need for animals to be darted at close range or captured for the drugs to be administered. These drugs also have also shown negative effects on the reproductive behaviors of wild cervids (Powers et al. 2011). There are also public health concerns on consuming the meat of animals that have been treated and, since the elk in the Park cross jurisdictional boundaries where public hunting occurs, this precludes the use of fertility control in this herd. Therefore, using elk fertility control would not only have additional and unknown environmental effects when compared to other management tools, it also would not meet the need to redistribute elk in the Park.

Capture and Relocation of Elk

This alternative would have involved capturing live elk in GRSA and transporting them to other locations with suitable habitat, such as other parks, refuges, or Indian tribal lands. Although translocation has been used in the past by other NPS units as an elk management tool, this practice is no longer used by the NPS because of concerns about CWD. An NPS guidance memo dated July 26, 2002 strictly limits the translocation of elk into or out of NPS units without appropriate CWD surveillance. Translocation is defined as human-assisted movements outside the natural range of a population. Although GRSA is not immediately adjacent to areas where CWD has been found (CPW 2015b), moving elk from GRSA to other locations would still require considerable handling and testing of elk, and has the potential to move this disease to areas where it is not endemic. This results in too great of an environmental impact that could be avoided with other alternatives, and it was therefore dismissed from further consideration.

Bison Fencing/Containment Concepts Dismissed

The NPS considered multiple alternative fencing concepts to those analyzed in detail, but they were considered and dismissed as described below.

No Containment. The management of bison at GRSA with no containment fencing was dismissed. Implementing an open, free-ranging bison herd would inhibit the ability of the NPS to manage the bison, and would require partners on other private, state, and federal lands to be willing to accept the risks, impacts, and management responsibility outside the Park. To date, a sufficient number of willing partners have not come forward to make it possible for the NPS to manage bison without some amount of containment fencing. Therefore, the option for managing bison without containment fencing has been dismissed from further consideration, because it is not technically feasible.

Southeast Quadrant of the Park. The NPS considered containment fencing along the southern boundary of the Park along the entry road near the entry station. This would allow bison access to the area south of the dunefield and east of the existing bison fencing and may allow some bison to move into the visitor use area along Medano Creek, but would contain the animals on NPS land with fencing along portions of Lane 6, the Park access road, and the south boundary. This concept was dismissed for the following reasons:

Chapter 2: Alternatives

- the area to the south of the dunefield is dominated by sand sheet with sandy surface geology that is constantly shifting making the construction and maintenance of permanent fencing unfeasible;
- the area south and west of the dunefield contains significant cultural and archeological resources that could be damaged or disturbed by the increased presence of bison, fencing, and management; and
- allowing bison to roam into the visitor use areas along Medano Creek would result in management and visitor safety concerns.

Considering the above constraints, there are less environmentally damaging, less expensive, and more feasible fencing/containment solutions. Therefore, this option was dismissed from further consideration.

Fence the Entire Park and Preserve. The NPS considered the construction of bison fencing along the spine of the Sangre de Cristo Mountains, which coincides with the east boundary of NPS land (essentially the entire Park and Preserve). The construction of such a fence through rough, rocky, and wooded-terrain would be prohibitively difficult. Therefore, this concept was dismissed from further consideration because it is not technically feasible.

“Very Low” or “Very High” Bison Density Alternatives

In developing the recommended density range for bison, the NPS considered a “very low” density range of less than 0.001 bison per acre. This density range, which would translate to a total of approximately 26 to 60 bison on the GRSA landscape, was dismissed from further consideration based on informed expert opinion that at least 80 individual animals are needed for a viable population over the long term, and because it fails to maintain a single population at a large landscape level (Plumb et al. 2016).

The NPS also considered a “high” density range of greater than 0.01 bison per acre, which was dismissed from further consideration because, based on current understanding, it exceeds the historical occupancy pattern of bison in the San Luis Valley (Meaney and Van Vuren 1993). High quality forage habitats are limited in the San Luis Valley and likewise in GRSA, where the majority of habitats offer marginal quality forage. Such habitats are not believed to have perennially supported high numbers of bison, nor is there archeological evidence of high bison density in the San Luis Valley, compared to other areas of Colorado such as Middle Park and North Park where thousands of bison remains have been recovered (Meaney and Van Vuren 1993). In addition, research has demonstrated that “high” bison densities can contribute to the ecological degradation of certain habitats (Schoenecker 2012). Finally, “high” bison densities would require frequent and intensive management which would not be operationally feasible and would be inconsistent with the NPS goal to manage bison as free-ranging wildlife.

CHAPTER 3: Affected Environment



CHAPTER 3: AFFECTED ENVIRONMENT

INTRODUCTION

The “Affected Environment” describes existing conditions for those elements of the natural and cultural environment that could be affected by implementation of the actions considered in this GRSA UMP/EIS. These include vegetation, elk and bison, wilderness, archeological resources, and game damage. Relevant impact topics were selected based on regulatory and planning requirements and known or expected resource issues. The information provided in this chapter will be used as context for comparing the potential impacts of each alternative, which are presented in Chapter 4.

WETLAND VEGETATION

Overview

According to vegetation classification and mapping efforts published in 2010, there are 48 categories of vegetated lands in and around GRSA, plus an additional eight non-vegetated, sparsely vegetated, or developed categories (Salas et al. 2011). This mapping effort covered 413,031 acres of federal (NPS, TNC, USFWS, U.S. Department of Agriculture, USFS, Bureau of Land Management [BLM]), state, and private lands in the northeastern portion of the San Luis Valley. Wockner et al. collapsed the detailed vegetation classification from this original map into 13 vegetation types (Wockner et al. 2015). These vegetation types are depicted on Figure 12.

This UMP/EIS focuses on wetland vegetation communities on the sand sheet that are most commonly used by elk and bison for foraging or other purposes (e.g., wallowing, resting, thermal cover, shading) (Zeigenfuss and Schoenecker 2015). The wetland vegetation communities on the sand sheet that are the focus of this analysis are further broken into the following four communities for the sake of analysis (for a cross-walk of these communities, see Table 3):

- *Marsh* — depressional wetlands characterized by permanent to seasonal flooding common around the terminus areas of Big and Little Spring and Sand Creek in the far southwest corner of the Park. Vegetation is dominated by wetland sedge (*Carex*), spicksedge (*Eleocharis*) and rush (*Juncus*).
- *Salt flats* — widespread wetland type at low elevations, forming in closed basins west of the dunefield with heavy textured soils or where evaporation from a high water table promotes the accumulation of salts. Salt flat wetlands have a variable hydrologic regime driven by ground water (often resurfacing from aquifers). Productivity is generally low, and species composition is limited to salt-tolerant species including saltgrass (*Distichlis spicata*), greasewood (*Sarcobatus vermiculatus*), and saltbush (*Atriplex canescens*).

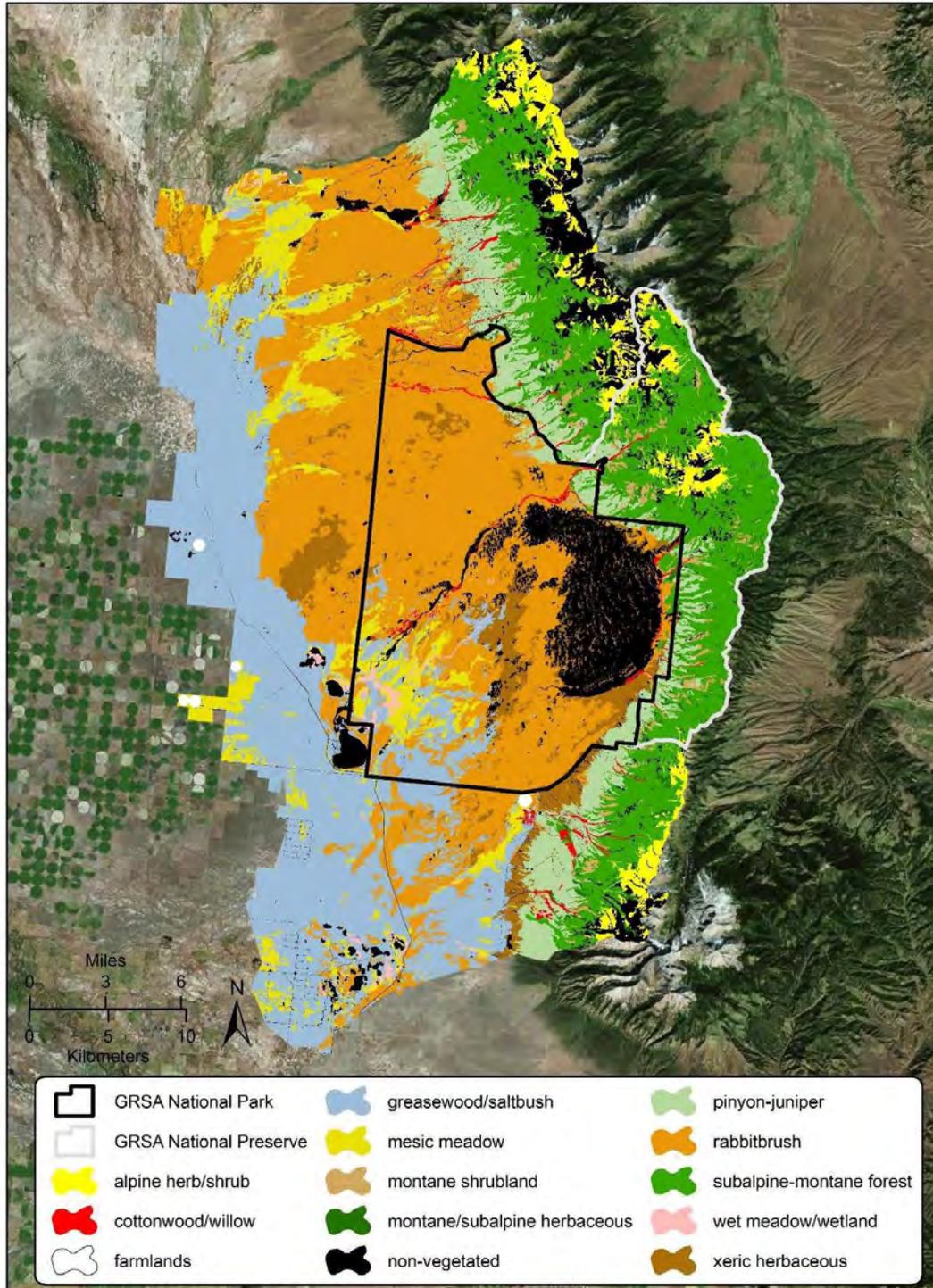


Figure 12. Vegetation types in GRSA (Wockner et al. 2015)

- *Wet meadows* — wetlands that typically exhibit a seasonally variable ground water driven hydrology with often saturated mineral soils. Wet meadow species include arctic rush (*Juncus balticus*), alkali sacaton (*Sporobolus airoides*), and sedges. Shrubs (commonly *Salix*) and trees may be present, but canopy cover is usually low. Understory diversity can be high.
- *Riparian wetlands* — wetlands along larger mid-elevation montane streams and lower in the foothill valleys. Riparian wetlands are seasonally saturated hydrologic regimes driven by associated surface water. The riparian wetland vegetation is highly variable. Some riparian wetlands are dominated by cottonwoods, with shrubs such as red-osier dogwood (*Cornus sericea*) and coyote willow (*Salix exigua*) and a diverse herbaceous understory. The cottonwood stands that occur along Sand Creek are considered unique for the southern Rockies, since they are pure narrow-leaved cottonwood (*Populus angustifolia*), while most other stands are hybrids of narrow-leaf and broadleaf (*P. deltoids*). Stream and riparian wetlands in GRSA are functionally unique owing to the high porosity of underlying sand.

Current Vegetation Status and the Role of Ungulates

Degraded conditions and vegetation type conversion exists in the Park as a result of long-term livestock grazing over the past 100+ years. Grazing by domestic cattle or sheep has not occurred in the Park since 2005. It is assumed that grazing by domestic cattle and sheep resulted in changes and degradation in native vegetation in the wetland vegetation communities in the Park. However, this UMP/EIS focuses on the role of current native ungulates, specifically elk and bison, on current conditions of wetland vegetation communities in the Park. Figure 13 depicts elk and bison together in a wet meadow wetland vegetation community in the Park.



Figure 13. Elk and bison on the Medano Ranch (2015)
Source: NPS

Both elk and bison use wetland vegetation communities to a greater extent than other communities in the Park (Figures 14 and 15) because these communities generally have green vegetation later into the summer when herbaceous vegetation in surrounding areas is not available (Zeigenfuss and Schoenecker 2015). Ungulate habitat use can have a diverse and important impact on habitat condition (Schoenecker et al. 2015; Schweiger et al. 2017). Ungulate habitat use includes a broad spectrum of behaviors including herbivory (feeding on plants), wallowing, horning, rubbing, resting, thermal cover, and shading. Herbivory can have profound effects on vegetation production, structure, and on multiple aspects of community composition. The influence of herbivory on ecosystem processes is shaped by the types of plants consumed, the intensity of

herbivory, the evolutionary history of herbivory, and the availability of water and nutrients to plants (Milchunas and Lauenroth 1993). Ungulate habitat use becomes a disturbance when it surpasses a level where positive effects from grazing or browse (i.e., stimulating production) are exceeded by negative impacts from how and when ungulates use habitat. These disturbances include removal of select plant species, erosion and soil compaction caused from hoof punching, wallows or trails, and introduction of invasive species (Schweiger et al. 2017). Evidence of soil compaction and resulting impacts on vegetation and soil conditions necessary for stream channel health has been demonstrated (Figure 5). In addition, evidence of complete removal of plant species resulting in erosion has been demonstrated (Figure 6).

ROMN recently published an analysis of the first park-wide survey of wetlands in 2010 (Schweiger, et al. 2017). The network modeled vegetation metrics, environmental covariates, and ungulate use to measure overall ecological integrity. Schweiger et al. (2017) presents analyses of a large long-term monitoring data set collected in 2010 at 75 wetland sites on the sand sheet sites, 13 of which were also monitored from 2010 to 2014. The salt flat and wet meadow sites were randomly selected and are thus a representative sample of these wetland communities on the sand sheet. A subset of sites were chosen specifically to better document how ungulate use and other disturbances affected wetland condition along a gradient of little or no ungulate use to very intensive ungulate use (particularly in the marsh and riparian communities, using paired exclosures). Multi metric models (Schoolmaster et al. 2012; Schoolmaster et al. 2013a, 2013b) of the effects of ungulate habitat use on vegetation composition were developed where the effects of human disturbance and a suite of environmental variables were controlled. Under these controlled conditions, the models isolated an estimated condition due to ungulate wetland habitat use (measured as Ungulate Use Index [UUI], or overuse in some cases). This ungulate use metric takes into account the disturbances listed above: removal of select plant species, erosion and soil compaction caused from hoof punching, wallows or trails, and introduction of invasive species.

Table 2 summarizes the 2010 condition results of the salt flat and wet meadow (salty meadow) wetland monitoring that was developed using assessment methodology established by the US EPA (*in review*) and the ROMN (Schweiger et al. 2017).

Table 2. Condition for salty meadow wetland on the sand sheet

Condition Class	Approximate Percent Sand Sheet Area (95% confidence interval)	Extent Estimate (acres)
Pristine reference condition (UUI = 0)	7 (1-13)	295.3
Reference condition (UUI = 1-57)	38 (27-49)	1,333.9
Intermediate condition (UUI = 58-83)	23 (12-34)	1,288.9
Non-reference condition(UUI = 84-100)	32 (21-43)	1,354.9
Total	100	4,272.9

Source: Schweiger et al. 2017

Results showed a strong relationship across samples (or across space) in 2010 between wetland integrity and ungulate use. Only around 7 percent of the salty meadow wetland (further defined in Table 3) on the sand sheet had an ungulate usage level that was assumed to be sustainable (UUI = 0). Figure 16 depicts the UUI from the analyses of wetland sites in 2010 (Schweiger et al. 2017). Higher values (i.e., more ungulate habitat use) are shown with larger bubbles and deeper red colors and indicate a decrease in integrity related to ungulate use.

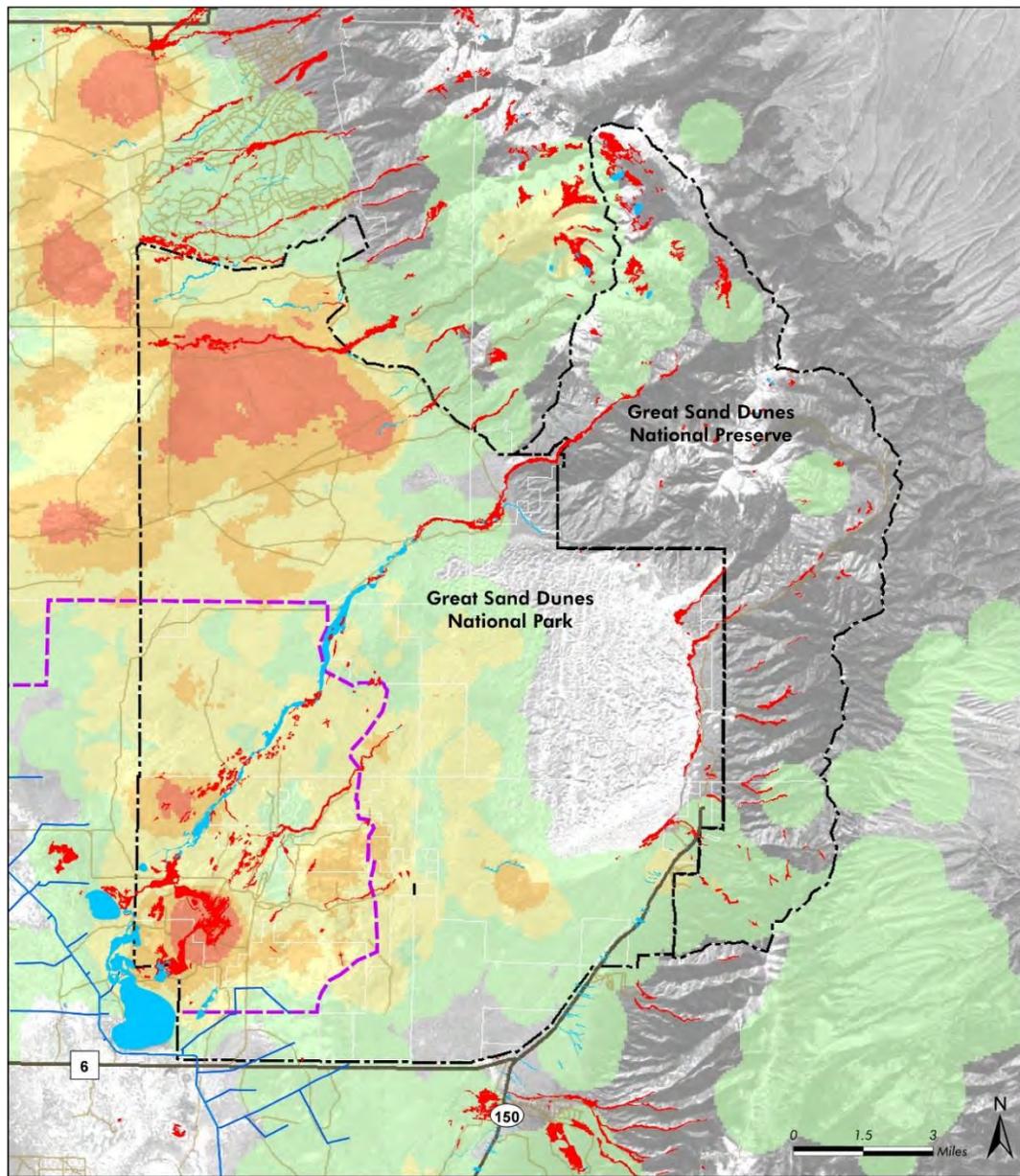
Schweiger et al. (2017) found that overall wetland ecological integrity strongly decreased with higher levels of ungulate use. Important components of wetland vegetation, including sedge and woody cover, strongly decreased with increased ungulate use of wetland habitat. The cover of

Table 3. Wetland vegetation communities

ROMN Wetland Classification	Vegetation Map Classification	Area on Sand Sheet (acres)	Pristine Reference Condition Area (acres)	Reference Condition Area (acres)	Intermediate Condition Area (acres)	Non-Reference Condition Area (acres)				
Marsh	Emergent Marsh	1,013.1								
	San Luis Valley Mesic Meadow									
	Playa									
	Water									
Riparian	Narrowleaf Cottonwood Alliances	989.2								
	Emergent Marsh									
	Coyote Willow Temp Flooded Shrubland	39.1								
	San Luis Valley Mesic Meadow									
Salty-meadow wetland		4,272.9					295.3	1,333.9	1,288.9	1,354.9
Salt flat	Alluvial Flat Herbaceous Alliances									
	San Luis Valley Mesic Meadow									
	Playa Alliances									
	Emergent Marsh									
	Greasewood Alliances									
	Sandsheet Rabbitbrush									
Wet meadow	San Luis Valley Mesic Meadow									
	Alluvial Flat Herbaceous Alliances									
	Interdunal Swale Wetland Alliances									
	Emergent Marsh									
	Sandsheet Rabbitbrush									
	Water									

Cross hatching indicates data is unavailable

salt tolerant species increased with ungulate use, which shows degraded wetland habitat (at least for wet meadows and riparian wetland) associated with excessive ungulate use. However, there were instances where the native forb cover elements showed a positive response to ungulate habitat use. This may be evidence of the ‘positive grazing effect’ (Augustine et al. 1998; Gough and Grace 1998; Wolf et al. 2007; Kaczynski and Cooper 2015) and supports the concept that some level of native ungulate use is likely necessary for ecologically healthy wetland communities (Schweiger et al. 2017).



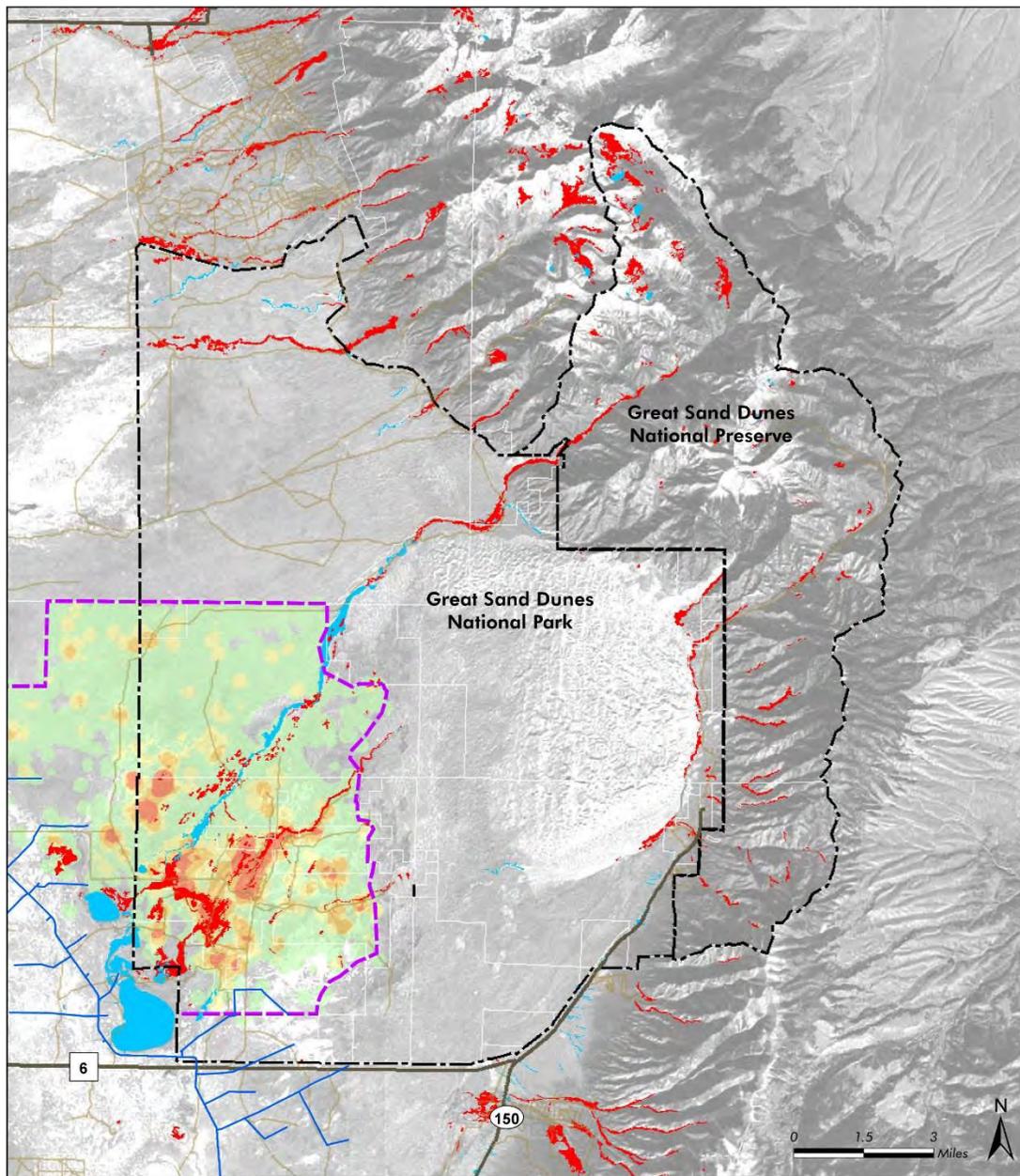
Great Sand Dunes National Park and Preserve Ungulate Management Plan

Prepared for: NPS
 File: 4413 Elk Counts.mxd [dlh]
 August 14, 2017

- | | |
|--------------------------------|----------------|
| TNC Bison Fence | Elk Counts 0>6 |
| National Park Service Boundary | 6-13 |
| Water | 13<22 |
| Wetland | 22-43 |

Note: Density data are from Wockner et al. (USGS 2015a) and show the number of overlapping elk ranges per 30-meter cell as estimated from flight, ground, and satellite based methods. Breaks in symbology are from Jenks (1967).

Figure 14. Index of relative elk density (2005–2007) in relation to wetland vegetation communities



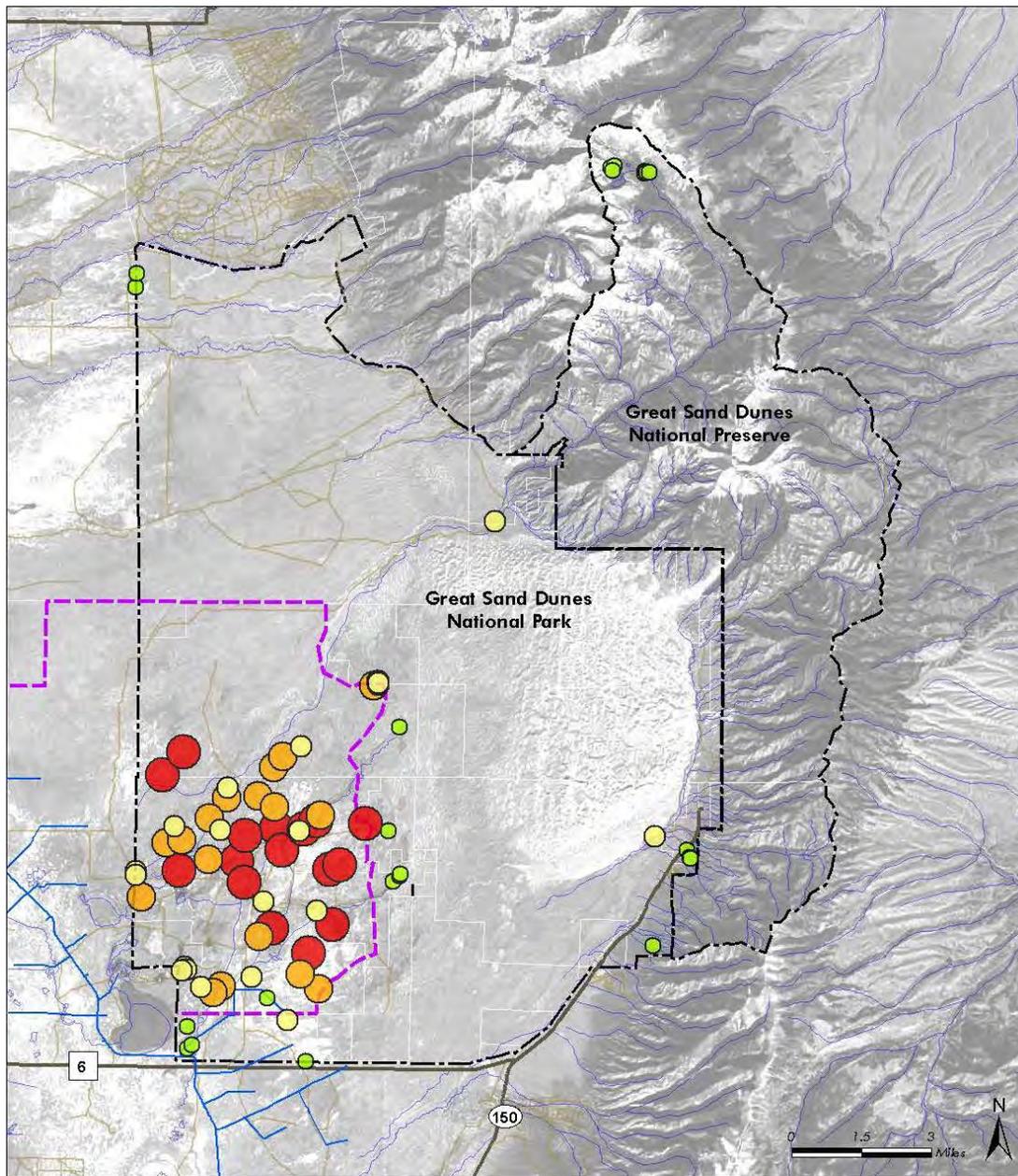
Great Sand Dunes National Park and Preserve Ungulate Management Plan

Prepared for: NPS
 File: 4413 Bison Counts.mod [dlH]
 August 14, 2017

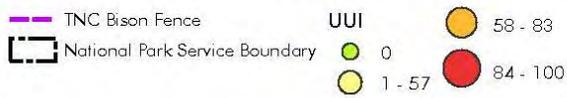
- | | |
|--------------------------------|-------|
| TNC Bison Fence | 0>4 |
| National Park Service Boundary | 4-8 |
| Water | 8<13 |
| Wetland | 13-19 |

Note: Density data are from Wockner et al. (USGS 2015a) and show the number of overlapping bison ranges per 30-meter cell as estimated from flight, ground, and satellite based methods. Breaks in symbology are from Jenks (1967).

Figure 15. Index of relative bison density (2005–2007) in relation to wetland vegetation communities



Great Sand Dunes National Park and Preserve Ungulate Management Plan



Higher ungulate use is shown with redder colors and larger symbols.

Figure 16. Ungulate use index in 2010 (modified from Schweiger et al. 2017)

Monitoring sites selected by ROMN within the marsh and riparian wetland vegetation communities were chosen specifically to better document how ungulate use and other disturbances affected wetland condition. Monitoring locations in these vegetation communities include paired site (inside and outside exclosures) as well as other sites specifically selected, rather than randomly selected. Results from marsh sites from 2010 to 2014 indicated that, for paired sites, ecological condition inside the exclosures was higher than that outside the exclosures with both sites inside the exclosures progressing from just above non-reference to above reference from 2010 to 2014. Alternatively, within the paired sites, conditions ranged from above reference in 2010 for one of the sites, to well below the non-reference assessment point and consistently below non-reference in the other site (Schweiger et al. 2017).

Similarly with the set of riparian sites that were selected (two inside exclosure and two paired outside the exclosure), ecological condition of those sites inside the exclosures improved from non-reference to above reference from 2010 to 2014 while the condition in the paired sites decreased to non-reference condition (Schweiger et al. 2017). These results concur with those reported by USGS in previous research on cottonwood and willow vegetation in riparian vegetation communities.

The USGS study, investigating the efforts of elk and bison herbivory, looked at seven research exclosures erected in cottonwood stands in riparian wetlands in the Park and the Medano Ranch in areas with elk plus bison and areas with only elk (Schoenecker 2012). Cottonwood tree size and density, sapling density and height, and ungulate browsing levels were monitored from 2005–2009 inside and outside of these research exclosures. This research led to the determination that GRSA cottonwood communities are sensitive to excessive herbivory (Zeigenfuss and Schoenecker 2015).

Likewise, evidence of heavy browsing on willow (specifically in Sand Creek) was reported and signs (tracks and scat) suggest extensive elk and bison use of the area. Research shows that exclosed coyote willows in GRSA respond positively to removal of ungulate herbivory (Figure 17). After four years in the exclosure area, the coyote willow were nearly twice as tall, absolute willow canopy more than doubled, and the willow canopy area was larger than willows subject to ungulate herbivory outside of the exclosures (Zeigenfuss and Schoenecker 2015).



Figure 17. Willow growth within an ungulate exclosure in proposed wilderness. Note the complete absence of willow and other vegetation outside the exclosure as a result of ungulate browsing (2016).

Source: NPS – ROMN

Schoenecker (2012) noted that browsing rates were higher in summer than winter on both cottonwood and willow and the percent summer herbaceous offtake was higher in elk-bison than elk-only willow communities. These results suggest that behaviorally ungulates are seeking shade and cover in the hot summer and browsing/grazing while occupying the understory, as opposed to relying primarily on browse in the winter for their primary food source as they do in other more temperate systems such as Yellowstone National Park (Schoenecker 2012).

ELK AND BISON

Elk

Species Background. Elk once occupied the eastern plains of Colorado, but today primarily occupy the western two-thirds of the state, and are mostly associated with semi-open forests or forest edges adjacent to parks, meadows, and alpine areas (Fitzgerald et al. 1994). Elk habitat preferences tend to be very site specific, but some general patterns are evident. In general, elk prefer open woodlands and avoid dense unbroken forests, especially as cover during the summer months. However, elk also use grasslands for foraging and rest in these habitats during winter when temperatures are cooler (Senseman 2002).

Elk are considered generalist feeders (grazers and browsers), foraging on a variety of grasses, forbs, and shrubs throughout the year. Forage preferences vary among seasons, habitats, and years, and are influenced by plant species availability, phenology, and palatability. Snow conditions can have a major impact on forage availability and the winter diet of elk. As snow depth increases, elk decrease their use of low-growing herbs and shrubs and increase their use of tall shrubs, conifers, and arboreal lichens. In spring, elk shift their foraging to species that begin growing early (mainly grasses) and increase their use of forbs or shrubs as spring and summer progress. By fall, dried grasses and shrubs make up most of the diet of elk (Cook 2002).

Elk typically spend about 90 percent of the day eating and resting, usually foraging near sunrise and sunset, and resting during the middle of the day (Skovlin 1982). Elk generally do not move more than about one kilometer during their daily activities, and favor relatively steep slopes (15 to 30 percent) for bedding grounds (U.S. Department of Agriculture 2007).

Breeding occurs in Colorado during mid-September to mid-October, with females giving birth the following spring (late May to early June). Females with calves tend to isolate themselves from the herd for the first two to three weeks, seeking solitude in forest or shrubland areas (Fitzgerald et al. 1994). Calves are mobile within days after birth and are often concealed in heavy cover for extended periods of time while the mother feeds or beds. As the calf grows, females and their young gradually return to the herds, and their calves are usually weaned by late summer, within 60 days after birth (Raedeke et al. 2002; Senseman 2002).

Local Elk Population: Habitat Use, Distribution, and Home Range. The Park is considered year-round habitat for elk, which use the sand sheet wetlands, shrublands, dunefield, and subalpine forest life zones and may also be seen along the forested periphery of the alpine tundra life zone (NPS 2007). They may seasonally migrate up into montane meadows or alpine tundra, but some herds stay on the valley floor year-round (NPS 2015a). USGS (2006) observed that elk summer (June–August) home ranges varied depending on whether they migrated. Home ranges were larger for elk summering on the valley floor than for elk that migrated to high-elevation summer range.

Elk movement to the winter range is usually initiated by hunting pressure on adjacent lands and snow cover. This movement of elk generally begins in September and continues until December (CPW 2010). Figure 18 depicts an aerial view of elk in the



Figure 18. Aerial view of elk in GRSA (winter 2005)
Source: NPS

Park during winter 2005. Areas to the west and north of the dunefield (particularly the areas between the dunefield, mountain front, and Baca Grande subdivision) are considered winter concentration habitat (Figure 18). With the exception of the dunefield, the majority of the Park is considered severe winter range (that part of the overall range of elk where 90 percent of the individuals are located when the annual snowpack is at its maximum and/or temperatures are at a minimum in the two worst winters out of ten) (CPW 2010, 2017) (Figure 2 and Figure 19).

Twenty percent of severe winter range for the entire Sand Dunes herd (CPW DAU E-11; see Figure 2) is on NPS land and 19 percent is on land owned by USFWS (NPS 2015a). Based on winter classification flights between 2006 and 2017, an average of 75 percent of elk classified in the DAU E-11 winter in GRSA (Table 4), which is a disproportionate percentage and a much higher than anticipated population (CPW 2017; NPS 2015a). In early 2017, an 8-hour winter classification flight conducted by CPW and funded by an NPS cooperator (Western National Parks Association) classified 2,925 elk inside GRSA and another 825 elk adjacent to GRSA (within 10 miles) (Table 4) (CPW 2017). Based on these results, the northeastern San Luis Valley elk herd was estimated to be approximately 5,600 animals (modeled) (Frankland, pers. comm. 2017).

Table 4. Winter elk distribution in and adjacent to GRSA

Year	Elk Inside GRSA	Elk Adjacent to GRSA*	Total Elk Classified in and Adjacent to GRSA	Percentage of Elk on NPS Land
2006	2,910	1,030	3,940	74
2007	2,938	1,569	4,507	65
2008	2,723	384	3,107	88
2011	1,840	515	2,355	78
2013	2,532	590	3,122	81
2014	2,289	1,300	3,589	64
2017**	2,925	825	3,750	78
Average	2,594	888	3,481	75

Source: CPW 2017; NPS 2015a

Note: This information only represents the January/February distribution inside and adjacent to the GRSA, which is based on CPW classification data. It is based on group size and sightability estimates (or counts). Data not available for the following years, because classification flights are not conducted every year: 2009, 2010, 2012, 2015, and 2016.

*Includes elk classified in in DAU E-11 that were not inside GRSA.

**Increase in numbers observed in 2017 is partially attributable to increased survey/flight time (i.e., 8 hours versus 4 hours).

The main limiting factor for the Sand Dunes elk herd is the amount of winter range, particularly severe winter range, available. Overconcentration of elk on the winter range can damage the habitat and can also force animals onto agricultural fields (CPW 2010). In addition, the absence of a predation threat diminishes the vigilance exhibited by elk, particularly cows with calves (Liley and Creel 2007; Landré et al. 2001). This, combined with lack of hunting pressure within the Park can lead to elk foraging for longer periods in locations that no longer pose threats or stress (e.g., predation or hunting pressure). This behavior contributes to the disproportionate use of habitat within the Park.

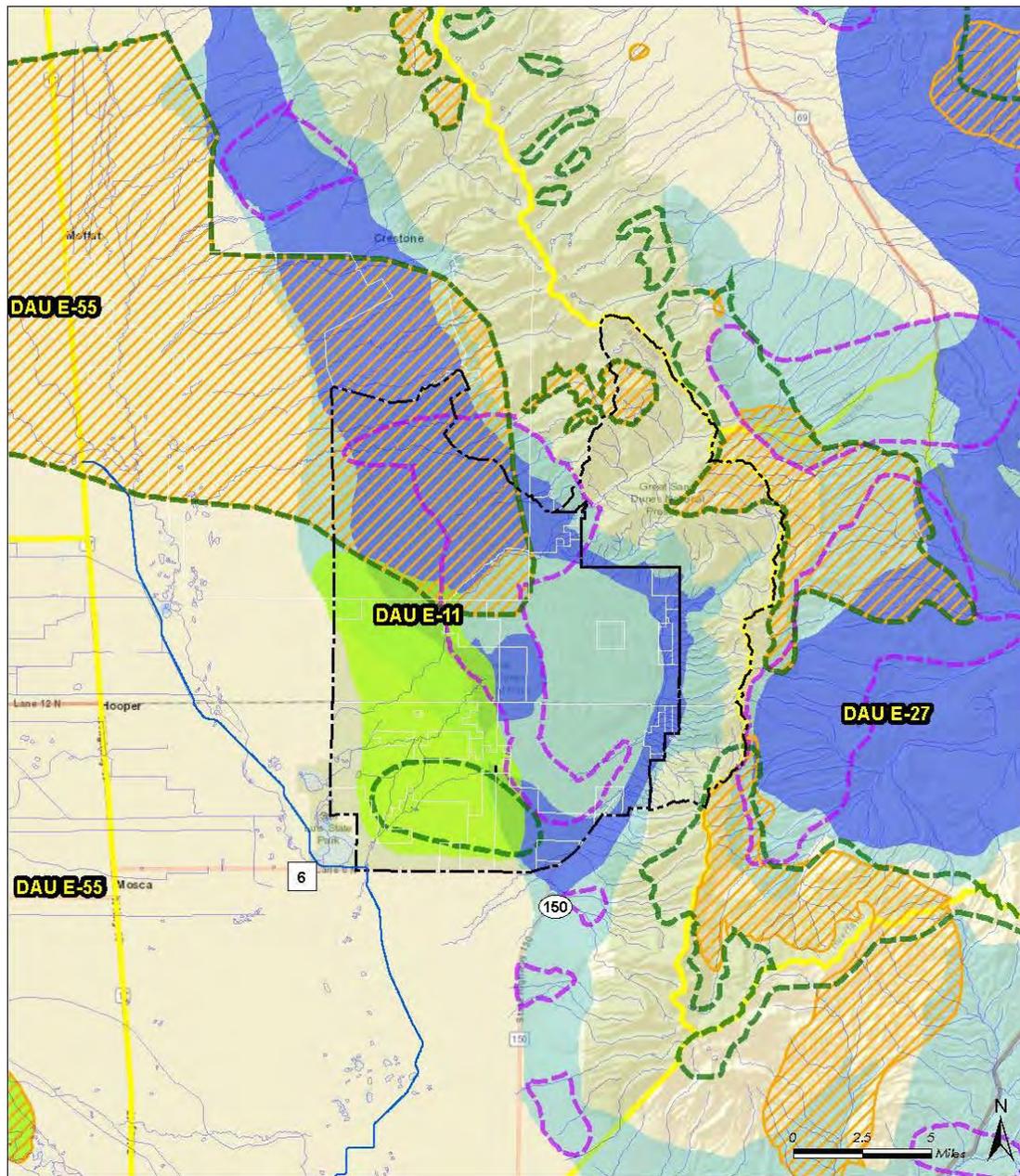
Migration back to the summer range usually follows the melting snow prior to calving, although some animals may remain in wintering areas (CPW 2010). Higher elevation habitat in the upper Deadman Creek and Sand Creek drainages are considered summer concentration and production (calving) areas as well as most of the valley floor north and east of the dunefield (CPW 2016a) (see Figure 19). Most of the Medano Ranch is also considered an elk resident population that includes year-round use of a population (CPW 2016a). Figure 19 highlights elk summer and winter concentration areas, as well as production areas in and around GRSA. Figure 14 in the “Wetland Vegetation” section shows relative elk density in and adjacent to GRSA based on elk location data (flight-, ground-, and satellite-based methods) collected by NPS, USGS, and CPW from 2005–2007. The densities presented in Figure 14 are relative concentration of animals that provide only an index to actual counts (Schweiger et al. 2017; Wockner et al. 2015).

Local Elk Population: Growth and Productivity. A USGS study on elk population dynamics in GMUs 82 (or DAU E-11) and 861 (see Figure 2) found that the elk herd grew rapidly (averaging 12 percent annually) from 1983 to 1989, but was followed by a population decline in 1990 (due to a combination of low precipitation and high female harvests) (Lubow and Schoenecker 2009). In 2000, the population growth rate was estimated at 11 percent, and there was another population decline in 2003–2004. The herd then grew to an estimated 4,000 elk by 2005 (USGS 2006; Schoenecker, pers. comm. 2010). From 2005 to 2007 the growth rate was estimated to be about two percent annually (Lubow and Schoenecker 2009) and decreased to less than one

Chapter 3: Affected Environment

percent by 2010 (Schoenecker, pers. comm. 2010). The recent decrease in the herd's growth rate is consistent with other herds in the southwestern United States (Schoenecker, pers. comm. 2015).

According to CPW the elk population cow/calf ratio in the area that encompasses GRSA averaged 35 calves per 100 cows from 1988 to 2008 was (CPW 2010). Elk population modeling conducted by USGS in 2005 indicates there is a higher female calf survival rate than male in the Sand Dunes elk herd, and the rate of calves per 100 cows has been declining. Although the exact reason for this downward trend in productivity is unknown, there are several factors that may be contributing, including an increasing population (as the population increases, productivity decreases), forage quality/quantity, climate change impacts, and predation.



Great Sand Dunes National Park and Preserve Ungulate Management Plan

- National Park Service Boundary
- Elk Resident Population Area
- Elk Summer Concentration Area
- Elk Severe Winter Range
- Elk Winter Concentration Area
- Elk Winter Range
- Elk Production Area
- CPW Game Units

Prepared for: NPS
 File: 4413 Elk.mxd [djh]
 February 23, 2018

Information on this map is provided for
 purposes of discussion and visualization only.

Habitat information:
 Colorado Parks and Wildlife October 2017

Figure 19. Elk population concentrations and production areas (CPW 2017)

Bison

Species Background. Once found throughout North America, American bison currently exist on less than one percent of their former range (Gates et al. 2010), and are now limited to commercial and conservation herds (NPS 2015e). It is estimated that there were once 30 to 60 million plains bison in North America (Rickel 2005). By the mid-1880s, bison populations were reduced to a few hundred animals because of overhunting, habitat loss, and environmental factors (Boyd and Gates 2006; Freese et al. 2007). Through conservation efforts and the expansion of commercial bison herds, bison numbered an estimated 75,000 in 1983 (Meagher 1986), about 150,000 in 1999 (Knapp et al. 1999), and currently number more than 500,000 animals (NPS 2010). Of those, approximately 19,000 are distributed across 54 conservation herds, which are managed by government agencies or conservation organizations (USGS 2015).

Primary habitat consists of open grassland, mountain valleys, and parks dominated by grasses and sedges. However, bison are also known to occupy shrublands and pinyon/juniper woodlands (Fitzgerald et al. 1994). They are primarily grazers whose diet comprises grasses, sedges, some forbs, and rarely shrubs (Cooperrider et al. 1986). Bison tend to avoid forbs and woody species, which usually constitute less than 10 percent of their diet (Plumb and Dodd 1993); however, this can vary depending on the environment. Their large digestive tract allows them to digest lower quality foods with greater efficiency than other ungulates such as cattle, deer, or elk (NPS 2015e). When bison coexist with other ungulates, interspecific competition is minimized through differences in habitat use and food habits (Meagher 1986) (Table 5). Although bison and elk share similar forage, the wide feeding niches of elk limit competition (Rickel 2005).

Table 5. General ungulate habitat preferences

Species	Diet			Habitat
	Browse	Forbs	Grasses	
Bison	Low	Low	High	Open grasslands
Elk	High	Moderate	High	Open grasslands and meadows, shrublands, and forests
Mule deer	High	Moderate	Low	Open shrublands and forests
Pronghorn	High	High	Low	Open grasslands and shrublands
Bighorn sheep	High	Low	High	Alpine meadows, rock outcrops, and open shrublands

Source: NPS 2010b

Bison are mostly active during the day and at dusk. Herds of any size will typically not spend much time in any one place. Bison herds are constantly on the move, feeding from one site to the next, because of the large quantities of forage they require. They will seek out higher-quality forage, but those sources are generally available only on a short term, seasonal basis (DOI et al. 2000).

Local Bison Population. As stated in Chapter 1, a population of bison ranging in size from 1,200 to 2,000 ranges freely in the 39,784-acre Medano Ranch (Wockner et al. 2015) and is the only bison herd in the San Luis Valley. The 2016 estimate for the herd was approximately 1,700 animals (TNC 2016). Figure 20 depicts bison in and around Dollar Lake on the Medano Ranch, taking in 2006.

Schoenecker (2012) estimated population demographics of the San Luis Valley bison herd from data collected during annual roundups from 2004 through 2011, which provided the first vital rates for bison inhabiting an arid ecosystem. The survival of all age/sex classes of bison

in the San Luis Valley was high (≥ 75 percent). The highest survival was in adult females (94 percent) and the lowest in yearling females, which was also the most variable (61 to 96 percent) of the four age/sex classes modeled. Yearling plus adult male survival was 87 percent (72 to 98 percent) (Schoenecker 2012).

Location data shows that the TNC bison herd uses all habitat types to some degree throughout the year, but demonstrates a strong multi-seasonal selection for marsh and wet meadow habitats, as well as a strong winter selection for riparian habitats (Schoenecker et al. 2015). Table 6 shows the estimated density of bison (per km²) by vegetation type and season on the Medano Ranch. Figure 15 in the “Wetland Vegetation” section shows the bison range in the existing fence, based on radio collar data collected during 2005–2007 (Schoenecker et al. 2015; Wockner et al. 2015).



Figure 20. Bison in and around Dollar Lake on the Medano Ranch (2006)

Source: NPS

Table 6. Estimated bison density by vegetation type and season on the Medano Ranch

Vegetation Type	Area (km ²)	Bison Density (animals/km ²)				
		Winter	Spring	Summer	Fall	Annual
Sand dune	1.2	4.35	1.45	2.54	4.17	2.03
Willow	0.1	0.17*	2.53*	2.54*	5.58*	1.04*
Greasewood	29.4	4.48	1.18	1.32*	3.56	2.36
Xeric grasses	13.0	11.95	9.54	1.71	6.91	7.34
Meadow	25.7	30.86	30.33	35.34	36.52	33.17
Cottonwood	0.8	0.17	2.53	2.54*	5.58	1.04
Playa	1.7	0.06	2.72	9.40	2.42*	2.81
Wash	1.1	10.46	4.03	1.91	8.17	4.67
Wetland	4.4	33.05	63.64	71.40	35.80	54.81
Rabbitbrush	75.2	3.35	3.54	2.54	2.42	2.99

Source: Schoenecker et al. 2015

*Vegetation type too rare to include in seasonal model calculations. Willow values were assigned to cottonwood, because they were spatially contiguous with a similar woody community. Other rare types were assigned values from the reference condition (rabbitbrush).

WILDERNESS CHARACTER

The 1964 *Wilderness Act* created the National Wilderness Preservation System and recognized wilderness “as an area where the earth and its community of life are untrammelled by man, where man himself is a visitor who does not remain.” The Act further defined wilderness as “an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions...” (16 U.S.C. 1131-1136).

The Great Sand Dunes Wilderness Area (35,955 acres), comprised primarily of the main dunes in the Park, was established in 1976 by Public Law 94-567, and amended in 1978 by Public Law 95-625. The Sangre de Cristo Wilderness Area was established by the Colorado Wilderness Act of 1993 (Public Law 103-77). In the year 2000, 39,686 acres of the Sangre de Cristo Wilderness, which is now in the Preserve, was administratively transferred from the USFS to the NPS (Great Sand Dunes Act of 2000). Total designated wilderness in GRSA amounts to about 75,641 acres. In the Record of Decision for the GMP (2007), most undeveloped areas of new park land (53,013 acres) were recommended for wilderness designation. This includes 22,476 acres for immediate wilderness, and 30,537 acres for potential wilderness. The 53,013 acres recommended for wilderness in GRSA include previously mined and grazed lands with structures, cultural features, unimproved dirt roads, abandoned airstrip, and private ownership. The 22,476 acres recommended for immediate wilderness are federally owned lands that fully qualify to become wilderness.

National Park Service *Management Policies* (NPS 2006) states that all wilderness categories, including suitable, study, proposed, recommended, and designated, shall be treated as wilderness; thus, all categories of wilderness were considered in this analysis (Figure 21).

Managing wilderness in GRSA begins by clearly articulating the five qualities of wilderness character so these qualities can be protected in accordance with the mandate of the Wilderness

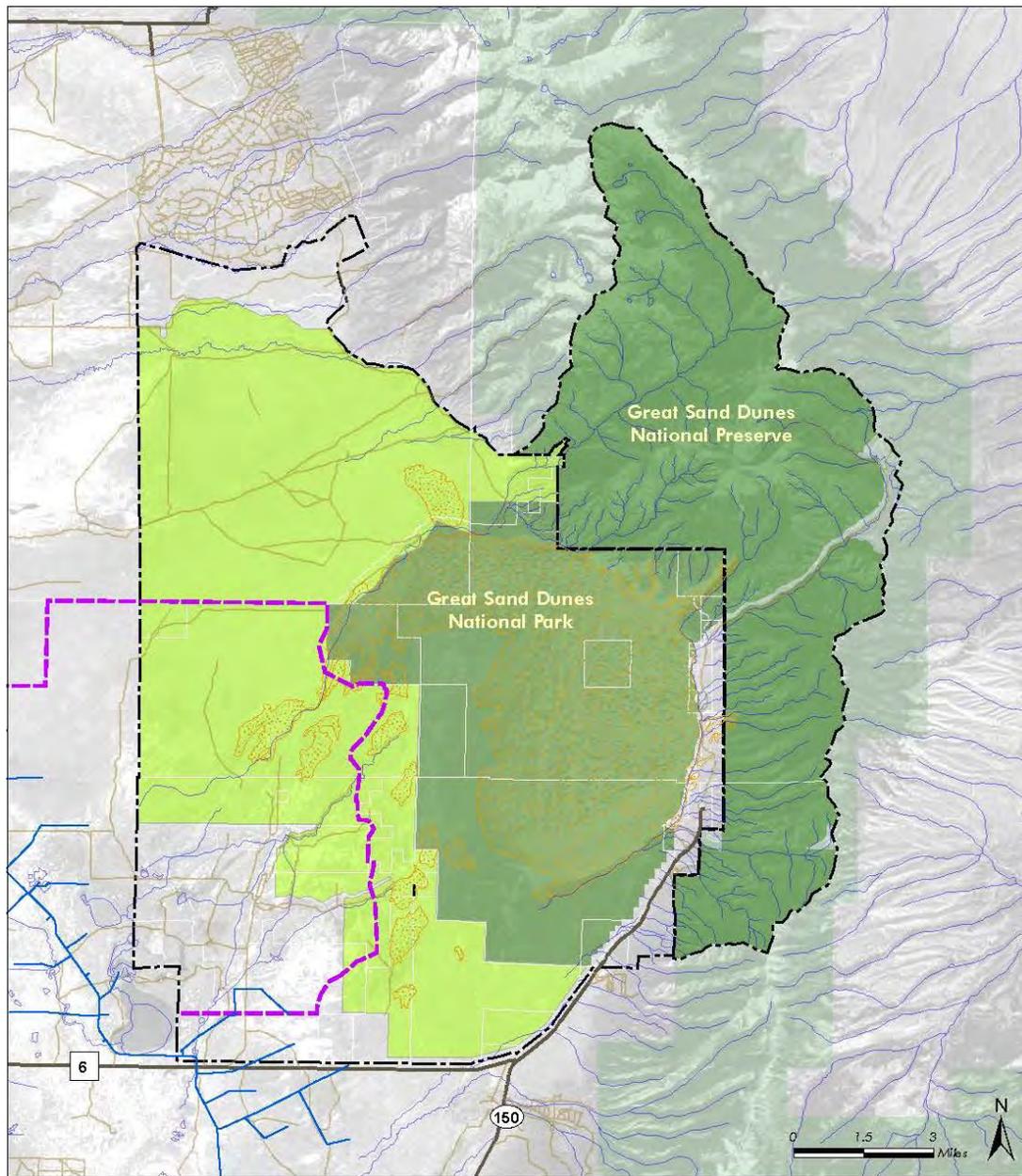
Act. The five qualities of wilderness character include (1) untrammeled, (2) natural, (3) undeveloped, (4) solitude or primitive and unconfined recreation, and (5) other features of value. Each of these qualities as they are defined for GRSA are described in the following sections, based on the *Great Sand Dunes Wilderness Stewardship Building Blocks* assessment developed in 2012 (Bogdanova 2012). These qualities define the affected environment for wilderness in GRSA, and establish a baseline for the evaluation of potential impacts.

Untrammeled. *Wilderness is essentially unhindered and free from modern human control or manipulation.*

This quality pertains to actions that manipulate or control ecological systems inside wilderness. The sand sheet, for example, is the largest component of the Great Sand Dunes geological system—about 90 percent of the sand deposit is found here and the sand’s constant movement is unhindered (NPS 2015f). The dunes are a byproduct of varied and changing wind patterns coupled with the presence or absence of vegetation. Because the sand sheet that encircles the main dunefield spans a major portion of the valley, these natural systems in place remain relatively free from modern human manipulation. More specific factors that affect untrammeled qualities in GRSA include restoration projects, fish stocking, wildlife collaring, water diversion, illegal campfires, and poaching (Bogdanova 2012). While management actions aim to protect native wildlife and vegetation at GRSA, some actions that are taken interfere with ecological processes and their components. The untrammeled quality of wilderness is supported or preserved when such management actions are not taken. It is degraded when such management actions are taken, even when these actions are intended to protect resources, such as spraying herbicides to eradicate or control nonnative species or collaring of elk for population studies (i.e., collaring) (Bogdanova 2012; Landres et al. 2015; Landres, Vagias and Stutzman 2012; NPS 2014).

Natural. *Wilderness ecological systems are substantially free from the effects of modern civilization.*

This quality pertains to the intended and unintended human-caused effects on natural resource conditions. Wilderness in GRSA consists of highly contrasting ecosystems formed by geologic processes and supporting a variety of plants and wildlife. The continuous wind and sand actions that erase and obscure the evidence of human use further contributes to the natural quality. Specific factors that affect natural qualities in GRSA include non-native/invasive species, sensitive and extirpated species, air quality, water quality, dune trampling, and climate change (Bogdanova 2012).



Great Sand Dunes National Park and Preserve Ungulate Management Plan

Prepared for: NPS
File: 4413 Wilderness Status.mxd [dfl]
March 5, 2018

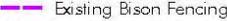
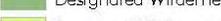
-  Existing Bison Fencing
-  National Park Service Boundary
-  Dune Field
-  Designated Wilderness
-  Proposed Wilderness

Figure 21. Designated and proposed wilderness in GRSA

Undeveloped. *Wilderness is essentially without permanent improvements or modern human occupation.*

This quality pertains to the presence of temporary or permanent scientific installations and facilities and the use of motorized equipment and transportation in wilderness. The undeveloped qualities of designated and recommended wilderness in GRSA include limited road access and minimal signs or improvements of civilization, when compared to other areas of the Park. This quality is preserved by the absence of structures and installations and refraining from these prohibited uses. It is degraded by the presence of structures and by nonconforming uses, whether by the agency for administrative purposes, by others authorized by the agency, or unauthorized uses by the public. Specific factors that affect undeveloped qualities include structures, fences, roads, and motor/mechanized vehicle use (Bogdanova 2012).

Solitude or a Primitive and Unconfined Type of Recreation. *Wilderness provides outstanding opportunities for people to experience solitude or primitive and unconfined recreation.*

This quality pertains to visitor opportunities to experience a primitive setting and remoteness from sights and sounds of people and recreational structures in the wilderness. The GRSA wilderness provides visitors with opportunities for solitude, inspiration, and remote primitive recreational activity away from high use areas. This quality is preserved or improved by management actions that reduce visitor encounters, signs of modern civilization inside wilderness, agency-provided recreation facilities, and management restrictions on visitor behavior. Specific factors that affect these qualities include numbers of visitors, condition of campsites, sky brightness, nighttime sound levels, number of trails, and visitor management restrictions (Bogdanova 2012).

Other Features of Value. *Wilderness preserves other tangible features that are of scientific, educational, scenic, or historical value.*

This quality captures important elements of wilderness not covered in the other four qualities, such as cultural or paleontological resources. Wilderness in GRSA protects an important cultural history and extensive archaeological record, and GRSA has identified cultural resources as an important component of wilderness character. This quality is preserved or improved when these resources are preserved and their loss or impacts on such features degrade this quality of wilderness character. A specific factor that affects this quality is the number of disturbances to cultural resources (Bogdanova 2012).

ARCHEOLOGICAL RESOURCES

The *National Historic Preservation Act* (1966, as amended) (NHPA) requires federal agencies to consider the effects of federal undertakings on historic properties and to provide the Advisory Council on Historic Preservation an opportunity to comment on the effect of the undertaking on historic properties. An undertaking refers to any federal action involving lands, funding, or issuance of a permit.

Historic properties are sites, buildings, structures, objects, districts, or traditional cultural properties that are either included in or have been determined to be eligible for inclusion on the National Register of Historic Places (NRHP). Archeological resources are the most common historic property in the UMP/EIS study area.

The NPS has established a 50-year guideline for potential historic properties (with the notable exception of Criterion Consideration G under NRHP Bulletin No. 15). Archeological resources were identified by conducting a file and literature review with GRSA and the Office of Archaeology and Historic Preservation (OAHP) and by consulting with experts familiar with the archeological resources in GRSA. Geographic Information System (GIS) data were used to confirm the location of identified archeological resources in park boundaries and to identify archeological resources in the fencing alternatives (using a 100-ft corridor centered on the fence alignments).

Archeological resources are evaluated for their eligibility to be listed on the NRHP under criteria codified under 36 CFR 60.4 of the NHPA. The federal agency determines those archeological resources that are potential historic properties in consultation with the State Historic Preservation Office (SHPO). Cultural resource locations are exempt from public disclosure under the Freedom of Information Act and are stipulated for nondisclosure under Section 304 of the NHPA to protect a resource from potential vandalism and to retain confidentiality of resources culturally significant to American Indian tribes. Thus, specific locations for prehistoric cultural resources are not included in this discussion.

Archeological Resource Overview

An archeological resource overview is included in this section to provide context for the type of archeological resources that may be affected by ungulate management activities. The overview is followed by a discussion of previous archeological resource inventories conducted and previous archeological resources documented in the UMP/EIS study area. Archeological

Archeological site is the physical evidence or remains of past human activity at a specific location. Prehistoric archeological sites predate written records, and historic archeological sites are generally associated with European exploration and settlement.

Historic property is any cultural resource included in or eligible for inclusion on the NRHP.

National Register of Historic Places is a registry maintained by the Secretary of the Interior of sites, buildings, structures, objects, districts or landscapes that have local, state, or national significance.

resources are the most common cultural resource in GRSA and most susceptible to potential effects from the proposed alternatives. Archeological resources in the Park include prehistoric (American Indian) and historic (post A.D. 1821) period sites. The following cultural overview is derived from *Colorado Prehistory: A Context for the Rio Grande Basin* (Martorano et al. 1999) and the synthetic report prepared from the 2000-2008 work in GRSA (Bevilacqua et al. 2011), unless otherwise referenced. The overall history of the upper Rio Grande Basin is divided into five major prehistoric and historic stages: Paleoindian (11,500 to 7450 BP), Archaic (7450 to 1450 BP), Late Prehistoric (1450 to 350 BP or AD 500 to 1600), Protohistoric (AD 1600 to 1860), and Historic (AD 1860 to 1965).

Paleoindian. The Paleoindian stage is primarily identified through highly stylized spear points such as Clovis and Folsom. Paleoindians were highly mobile hunter-gatherers who left few imprints on the landscape. Subsistence strategies focused on big game, which included now-extinct large mammals such as mammoth and *Bison antiquus*. GRSA contains some of the most significant Clovis and Folsom sites including Stewart's Cattle Guard (5AL101), Red Beds Complex (5SH2082/5AL93), Little Clovis (5AL94), Beck Folsom (5AL97), Rolling Points Blow (5AL113), and the One-Two-Three site (5AL123).

Archaic. The Archaic stage is characterized by broad spectrum hunting and gathering reflected in the increase in use of ground stone technology used to process natural resources for food, use of the atlatl, and increased diversity of fauna and flora used for food. Archaic camps are found around the several permanent springs in the western portion of the Park and are also commonly found exposed in sand sheet blowouts (e.g., 5SH3386).

Late Prehistoric. The transition between the Archaic and Late Prehistoric stages is recognizable in the archeological record from changes in technology (replacement of the atlatl with the bow and arrow, and adoption of ceramics), population increase, decrease in residential mobility, and more intensive processing of natural resources. After AD 1100 ceramic evidence suggests the arrival of Ute and Athapaskan speakers in the San Luis Valley (Gilmore and Larmore 2012; Larmore 2008). Ceramic evidence also suggests that Pueblo groups from the middle Rio Grande region were visiting the Sand Dunes after about AD 1400.

Protohistoric. The Protohistoric stage represents the time of European arrival into what is now the southwestern United States, and the indirect flow of European goods and disease into American Indian culture. For the Rio Grande Basin, this stage is reflected by the Spanish Entrada into the region in 1540. Ethnographic studies demonstrate that the Ute and Jicarilla Apache (Athapaskan speakers) frequently resided in the San Luis Valley and the region was visited by the northern Pueblos, Navajo, and the Comanche. American Indian occupation is recognizable by culturally modified trees and wickiup architecture, but European goods may be found in association such as at the Bunker site (5SH614).

Historic. The Historic stage specific to the San Luis Valley begins in 1821 with the establishment of the Old Spanish Trail used by Mexican and American trading expeditions. The East Branch of the trail (1829–1848) extended through the western boundary of the Park, continuing north along the base of the Sangre de Cristo range before heading west towards Saguache Creek and Cochetopa Pass. The Mexican government encouraged settlement of the valley by issuing land grants, a practice that the American government continued after gaining control of the region in 1848. The Baca Land Grant No. 4 was issued in 1860 for lands in what is now part of the Park. Mining has played a significant role in the Park's history, leading to the

establishment of several town sites in what is now the Park, including Montville (1887–1912) and Duncan (1890–1900). Ranching was and remains an important industry in the valley, exemplified by the Hispanic-American Trujillo family near Medano Spring in 1866 (Simmons and Martorano 2007). Both the Medano Ranch (Medano Ranch Headquarters – 5AL301) and the Trujillo Homestead are listed on the NRHP.

Documented Archeological Resources

The proposed alternatives have the potential to impact archeological resources in two areas of concern. These include: up to 40 miles of proposed fence alignments (with a 50-foot buffer on either side) that would constitute a new ground disturbing activity with the potential to affect significant archeological resources, and the valley floor within the Park that encompasses the maximum extent of ungulate range within the Park under the proposed alternatives.

Fence Alignment Resources. Twelve archeological resources have been documented in the area of concern associated with the fencing alignment. These resources include significant sites such as 5AL123 (Paleoindian), 5SH181 (Big Springs), the historical town site of Duncan (5SH3484), and the Liberty Stage Road. Of the 12 archeological sites in the area of concern for the fencing alignment, 10 are potentially eligible for listing on the NRHP and the remaining two have been recommended not eligible. The eligible archeological sites qualify under Criterion D (36 CFR 60.4) for their potential to provide information important to the interpretation of prehistory or history.

Valley Floor Resources. Archeological resources on the valley floor are concentrated primarily along stream corridors, near springs, and along the transition between the sand sheet and the woodlands. Resources are also found in areas of blowouts where the sand has been eroded to expose the underlying layers. Because much of the areas of concern has not been systematically surveyed for archeological resources, the actual number, extent, and condition of archeological resources is considered unknown.

Data provided by GRSA shows that there are 347 documented archeological resources in the valley floor area of concern (excluding those documented in the fencing alignment). The vast majority of these resources are prehistoric American Indian and many are likely to be eligible for listing on the NRHP. Data is not available regarding eligibility status for the 347 archeological resources on the valley floor area of concern. Generally speaking, about 20 percent of archeological resources become historic properties as a result of consultation; this percentage is a reasonable measure of the 347 known archeological resources that may be historic properties. However, for resources where eligibility is unknown, the NPS treats the resources as if they were eligible. Like the archeological resources along the fencing alignment, the archeological resources of the valley floor are likely significant under Criterion D, defined as the potential for archeological sites to provide information important to the interpretation of prehistory or history.

SOCIOECONOMICS: GAME DAMAGE

Big game wildlife and big game hunting are integral to Colorado's economy. Legal harvesting is the primary tool CPW uses to manage game animals. As described under the "Elk Population" section of this chapter, controlling the local elk population (DAU E-11/GMU 82; Figure 2) through harvest has been very difficult because of areas of private and federal land (such as the Park), where hunting is not allowed or is only allowed on a limited basis. CPW is currently trying to maximize the elk harvest in DAU E-11 and adjacent DAUs through license/hunter distribution. In addition, CPW is also working with the NPS, USFWS, and TNC to make the elk more available to hunters in attempts to decrease the elk population (CPW 2010) and reduce impacts associated with elk on the landscape.

CPW's Game Damage Program is a prevention and reimbursement program that compensates ranchers, farmers, and landowners for damage caused by big game animals, including elk. In fiscal year (FY) 2015, CPW paid out \$984,754 to settle 279 game damage claims, 35 of which (\$170,534) were related to elk. Specifically, CPW's Monte Vista office (which is the office closest to GRSA and DAU E-11) paid \$42,190 in crop/forage damage claims in FY2015 (CPW 2015a).

Game damage reimbursements are currently minimal in DAU E-11, despite the fact that elk are found on agricultural fields. CPW has averaged approximately \$15,000 in game damage over the last few years in DAU E-11 (Rivale, pers. comm. 2015). However, these numbers do not reflect the substantial amount of planning and funding that goes into prevention measures developed through various HPPs which include projects such as water developments, fencing, habitat improvements, noxious weed treatments, conservation easements, forage purchases, and hunt coordinators (CPW no date [n.d]). HPPs are funded by revenue from the sale of big game licenses and work through local committees to develop partnerships among landowners, land managers, sportsmen, the public, and CPW to reduce conflicts between big game wildlife and agriculture. In 2016, the Mount Blanca HPP included approximately \$68,000 in budget allocated by CPW to implement prevention measures (Kahn, pers. comm. 2018).

The game damage potential in the adjacent DAU E-55 (Figure 2) is more substantial as it has a high proportion of irrigated agricultural fields irrigated. Game damage in DAU E-55 is presumed to be caused by elk from E-11. Elk cross these DAU boundaries on a yearly cycle moving into E-55 in May and to E-11 in September. Crops commercially grown in DAU E-55 which may attract elk include alfalfa, spinach, lettuce, potatoes, and small grains.

One of the biggest concerns with the presence of elk on agricultural fields is the potential of elk spreading crop disease into a seed potato field. Elk crossing a commercial potato field and then entering a certified seed potato field creates the risk of a disease agent or pest being introduced. Should a field of seed potatoes become contaminated, it would result in the loss of disease-free certification, and the crop would have to be marketed as commercial potatoes at roughly half the original value. In this way the value of the crop could be substantially reduced with little or no loss in yield, giving rise to an extremely costly damage claim. It is estimated that the dollar value of such a claim could run into six figures, or even more than a million dollars should multiple fields or an entire farm be decertified because of an especially virulent fungal infection (CPW 2006). Because of this, DAU E-55 has a population objective of zero.

Chapter 3: Affected Environment

Special elk seasons were established in DAU E-55 beginning in 2005 to address an increasing elk population. The DAU's special seasons were created in an attempt to avoid potentially costly game damage to agricultural crops. One of these newly created seasons was an antlered elk hunt beginning May 15 and open until July 31. The goal of this season was to address large groups of bull elk, as many as 200, that were in alfalfa fields and crossing seed potato fields from late spring through late fall. The early season would allow hunters to disperse these animals and decrease the chance of game damage (2 CCR 405-2; CPW 2007). In 2009, a fall bull/cow season was implemented in DAU E-55 from August through December annually. This fall season utilized bull and cow elk hunting as a tool for managing the growing elk population in DAU E-55. Landowners growing late season cover crops (i.e., winter rye), which are vulnerable to elk in January and February, were experiencing severe elk game damage issues after the previous fall bull/cow season ended on December 31. Extending the fall bull/cow season to the end of February targeted those elk involved in agricultural conflicts (CPW 2016b).

Chapter 3: Affected Environment

CHAPTER 4: Environmental Consequences



CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This chapter analyzes the potential consequences, both beneficial and adverse, that could result from implementing any of the alternatives described in this EIS. The resource topics presented in this chapter and the organization of the topics correspond to the resource discussions contained in Chapter 3. This chapter begins with a brief explanation of general methods followed by a discussion of how cumulative impacts are analyzed for the alternatives. Following this section, the impact analysis is presented.

METHODOLOGY FOR ASSESSING IMPACTS

The planning team based the impact analysis and conclusions on review of existing literature and park studies, information provided by experts in the NPS and other agencies, professional judgment, park staff insights, and public input. In accordance with Council of Environmental Quality regulations, direct, indirect, and cumulative impacts are described (Title 40 of the CFR 1502.16), and the impacts are assessed in terms of context and intensity (40 CFR 1508.27). The analysis under each impact topic notes if significant impacts are anticipated given the context and intensity of the effects; where such an assessment is not included, no significant impacts are anticipated. Where appropriate, mitigating measures for adverse impacts are described and incorporated into the evaluation of impacts. The specific methods used to assess impacts for each resource may vary and, therefore, are described as part of each impact topic.

CUMULATIVE IMPACTS

The Council of Environmental Quality regulations require assessment of cumulative impacts in the decision-making process for federal projects. A cumulative impact is defined as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions” (40 CFR 1508.7). Cumulative impacts are considered for all alternatives, including the no-action alternative.

Cumulative impacts were determined by combining the impacts of the alternative being considered with other past, present, and reasonably foreseeable future actions. Therefore, it is necessary to identify other ongoing or reasonably foreseeable future projects and plans at GRSA and, if applicable, the surrounding region. Actions that could affect or have affected the various resources at GRSA are presented in Table 7 below.

Table 7. Cumulative impact scenario

Impact Topic	Past / Present Actions	Reasonably Foreseeable Future Actions
Vegetation	<p>Wells managed by the Bureau of Reclamation's Closed Basin Project are located within legislated park boundaries and extract approximately 913 acre feet of water from the unconfined aquifer beneath the Park</p> <p>Exotic plant management</p> <p>Water diversion from Big Spring and Little Spring Creeks and Sand Creek for agricultural irrigation to produce hay and forage for bison</p> <p>Groundwater pumping for agricultural activities along the western boundary of the Park</p> <p>Grazing by domestic cattle and sheep on the Baca and Medano-Zapata Ranches, resulting in changes to vegetation communities within the Park</p> <p>Implementation of elk hunting on Baca NWR</p>	<p>Restoration of native plant communities, specifically riparian areas consisting of reseeded following exotic plant management</p> <p>Changes to Colorado groundwater rules that are designed to reduce aquifer depletion.</p>
Elk	<p>Big game hunting on adjacent lands, including elk hunting on Baca NWR</p> <p>Fire management</p> <p>Construction and infrastructure related to Closed Basin Project and water extraction from the project's wells, which are located within legislated park boundaries</p> <p>Exotic plant management</p> <p>Road/utility construction and maintenance inside and outside of GRSA</p> <p>Water diversion from Big Spring and Little Spring Creeks and Sand Creek for irrigation to produce hay and forage for bison</p> <p>Groundwater pumping for agricultural activities along the western boundary of the Park</p> <p>Grazing by domestic cattle and sheep on the Baca and Medano-Zapata Ranches, resulting in changes to vegetation communities within the Park</p>	<p>Restoration of native plant communities, specifically riparian areas consisting of reseeded following exotic plant management</p> <p>Road/utility construction and maintenance inside and outside of GRSA</p>

Chapter 4: Environmental Consequences

Impact Topic	Past / Present Actions	Reasonably Foreseeable Future Actions
Bison	<p>Big game hunting on adjacent lands, including elk hunting on Baca NWR</p> <p>Water diversion from Big Spring and Little Spring Creeks and Sand Creek for irrigation to produce hay and forage for bison</p> <p>Groundwater pumping for agricultural activities along the western boundary of the Park</p> <p>Grazing by domestic cattle and sheep on the Baca and Medano-Zapata Ranches, resulting in changes to vegetation communities within the Park</p> <p>Implementation of elk hunting on Baca NWR</p>	<p>Restoration of native plant communities, specifically riparian areas consisting of reseeding following exotic plant management</p>
Wilderness Character	<p>Infrastructure (i.e., access roads and fencing)</p> <p>Management of vegetation and other resources in wilderness</p>	<p>Restoration of native plant communities, specifically riparian areas consisting of reseeding following exotic plant management</p>
Archeological Resources	<p>Fire management</p> <p>Construction and infrastructure related to the Closed Basin Project</p> <p>Agricultural activities on the Medano Ranch</p> <p>Water diversion from Big Spring and Little Spring Creeks and Sand Creek for irrigation to produce hay and forage for bison</p> <p>Road/utility construction and maintenance inside GRSA</p> <p>Grazing by domestic cattle and sheep on the Baca and Medano-Zapata Ranches, resulting in changes to vegetation communities within the Park</p>	<p>Road/utility construction and maintenance</p>
Socioeconomics: Crop Damage	<p>Special hunting regulations to reduce concentration of elk and game damage on the central valley floor</p> <p>Implementation of elk hunting on Baca NWR</p>	<p>None</p>

IMPACTS TO WETLAND VEGETATION

As described in Chapter 1, this impact topic focuses on impacts on the wetland vegetation communities (marsh, salt flat, wet meadow, and riparian) in the Park as these are most commonly used by elk, bison, or both for foraging or other purposes (e.g., wallowing, resting, thermal cover, shading). The impact analysis for vegetation focuses on potential changes to these communities from ungulate use (or overuse) resulting from implementation of the alternatives. The evaluation considers whether actions would be likely to result in an increase or decrease in the ecological integrity of these vegetation communities. In addition, the evaluation considers the impacts of the management actions to be taken and the effects they would cause to these vegetation communities during implementation.

Alternative 1

Under this alternative, TNC would continue to graze bison as a livestock herd on the Medano Ranch until government acquisition, at which time the bison herd would be removed by TNC as a condition of land purchase. While the bison are still on the landscape, the negative impacts from the overconcentration of elk and bison in wetland sites on the sand sheet within the Medano Ranch, as described in Chapter 3, would likely continue, and could worsen over time.

Bison are currently impacting wetland vegetation communities on the Medano Ranch (i.e., inside the bison fence). The complete removal of bison under Alternative 1 would reduce some pressure on wetland vegetation communities inside the bison fence which would likely improve the ecological integrity of these vegetation communities that are currently being impacted by both elk and bison. As depicted in Figure 16, all of but one of the sites surveyed within the bison fence showed a UUI greater than 1, with the majority of the sites falling within a UUI range of 58 to 100 range (indicative of unsustainable ungulate use) (Schweiger et al. 2017). Areas in the salty meadow wetland, which combines the salt flat and wet meadow communities, that are currently in less than reference condition (intermediate or non-reference) encompass approximately 2,644 acres, or 62 percent of the salty meadow wetland area (refer to Table 2) that could improve by removing bison. These improvements might not be fully realized, as the NPS would not have tools to manage elk overconcentration under this alternative. It is expected that elk overconcentration would continue and impacts as a result of elk disturbance (herbivory, erosion and soil compaction, creation of trails, introduction of invasive species, and alteration of height and structure in woody-dominated communities) in these communities could worsen over time when compared to current conditions. The roughly 1/3 of salty meadow wetland, or approximately 1,354 acres, that is currently in non-reference condition (UUI= 84-100) would likely remain in non-reference condition (Schweiger et al. 2017) and areas with intermediate or reference condition, or approximately 2,915 acres, could decline (Figure 16).

Results of monitoring within the approximately 1,013 acres that comprise the marsh wetland vegetation community and approximately 1,025 acres that comprise the riparian wetland vegetation community are indicative of impacts from ungulate use (or overuse) on a site-specific basis. In both vegetation communities, sites that had been exclosed for approximately ten years have improved to reference condition while the paired sites outside the exclosures were consistently below reference condition (Schweiger et al. 2017). While the study design was not intended to be representative of the condition of the communities in their entirety, as with the

salty meadow wetland communities, it can be assumed that impacts to these communities would be the same as the impacts to the salt flat and wet meadow communities. This would result in limited improvement across the impacted acreage as bison are removed but continued decline as the elk population would remain uncontrolled.

The desired condition is ecologically healthy and minimally disturbed wetland communities. Data demonstrates currently degraded wetland conditions that do not align with the desired condition. The level of intensity of impacts to wetland vegetation communities from ungulate use is not fully known as more focused research is needed to further examine the ungulate-wetland response dynamic in the Park (Schweiger et al. 2017). Impacts to wetland vegetation communities are important as they are integral to the maintenance of ecologically healthy and minimally disturbed wetlands that are considered an invaluable Park resource and a decline in wetland condition because of ungulate overuse would threaten the continued existence of this resource. Therefore, the potential for continued decline in wetland ecological integrity that could occur under Alternative 1 would result in significant adverse impacts.

The current remaining exclosure areas (18 total or approximately 18 acres; Figure 7) that have been established in the Park for research purposes would continue to be minimally maintained, as appropriate, for research. This would result in localized beneficial impacts by allowing increased cover and abundance of herbaceous wetland vegetation exclosures and increased height and canopy and survival of saplings in woody-species exclosures as has been demonstrated in monitoring results.

Potential adverse impacts associated with the removal of bison fencing would be limited to the localized loss of vegetation along the fence corridor. These impacts would occur through loss of individual plants along the fence corridor and ground disturbance that would result from equipment accessing areas to remove fencing. Under Alternative 1, approximately 1,300 linear feet of fencing would be removed within wetland vegetation communities. Assuming a disturbance buffer of 10 feet on either side of the fencing alignment, approximately 0.3 acres would be disturbed within wetland vegetation communities which is a small portion of the total 6,314 acres comprised of wetland vegetation. The resultant impact from fence removal would be adverse and could require vegetation restoration to ensure that invasive species do not establish in the disturbed area. Given the small size of the area that would be affected, adverse impacts associated with fence removal would be negligible.

Cumulative Impacts. Several actions (see Table 7) have the potential to combine with the effects of Alternative 1 to produce cumulative impacts on wetland vegetation communities, particularly water diversion and groundwater pumping activities, agricultural activities on the Medano Ranch and former Baca Ranch (irrigation and mowing/baling of hay, grazing by domestic cattle and sheep), big game hunting on adjacent lands (including Baca NWR) and exotic plant management. The effects of past and present actions described below have contributed to the current abundance and distribution of elk and bison, and the degraded condition of wetland vegetation communities described in the affected environment.

Currently, water is diverted from Big Spring Creek and Little Spring Creek to irrigate meadows on the Medano Ranch to maximize the amount of forage for bison. These irrigation practices have resulted in the conversion of areas that were formerly upland shrub habitat into seasonally wet meadows and the conversion of former riparian corridors into upland shrub habitat because

of water being moved from native channels. This has caused changes in the natural distribution and abundance of these plant communities

Although grazing by domestic cattle and sheep on the Baca and Medano-Zapata Ranches ended in 2005 (NPS 2007), it has resulted in changes and degradation in native vegetation in the wetland vegetation communities in the Park.

Although exotic plant management could result in some loss of individual plants (through trampling or inadvertent applications/drift to non-target species), wetland vegetation communities would benefit from exotic plant management and the subsequent restoration efforts. Exotic plant management would result in the removal of non-native plants that outcompete native species and the removal/suppression of these species would correspond to an increase in native plant cover and diversity. This is particularly important as the removal of bison from the Park would allow propagation of invasive species in areas that are currently bare ground due to bison disturbances. Restoration of riparian wetland vegetation following exotic plant management would greatly benefit these communities that have been demonstrably impacted by elk and bison.

Groundwater pumping practices that have been occurring to support the Closed Basin Project within the legislative boundary of GRSA as well as agricultural practices outside the legislated boundary of GRSA contribute to aquifer depletion and decrease the water table. Continuation of this practice would have an adverse impact on wetland habitats that depend on the relatively high water table. GRSA wetlands rely on a high water table (ranging from a depth of approximately two meters below land surface to saturation above surface [Schweiger et al. 2017]) and if the water table is depleted below these levels, then the wetlands can no longer function and vegetation that is able to thrive in these conditions would no longer be sustainable. Changes to groundwater rules that limit the amount of water that could be drawn from the aquifer would increase the availability of the high water table that these vegetation communities need to maintain ecological integrity.

Elk hunting on Baca NWR could result in more elk seeking refuge in the Park, which would increase impacts to vegetation, currently described due to elk overconcentration.

Despite some benefits from exotic plant management and reduction of practices contributing to aquifer depletion, the past and present actions described above would continue to result in adverse impacts from ungulate disturbances in wetland vegetation communities. While Alternative 1 could have some beneficial impacts to vegetation from the removal of bison, it is uncertain if such benefits would be realized and sufficient to offset the impacts of other cumulative actions, or if the current degraded condition of wetlands would continue or worsen. As a result, it is expected that overall adverse cumulative impacts would continue, and could be significant given the uncertainty over potential adverse impacts of Alternative 1 and importance of these vegetation communities to the Park. The significant adverse impacts under Alternative 1 would contribute substantially to these overall cumulative adverse effects.

Alternative 2

Under Alternative 2, TNC would continue to graze bison as a livestock herd on the Medano Ranch until government acquisition, at which time the bison herd would be removed by TNC as a condition of land purchase. Ongoing impacts associated with bison would continue as

described under Alternative 1, however, as described below, active elk management is expected to improve conditions in wetland ecological integrity.

As discussed under Alternative 1, approximately 2,644 acres, or 62 percent, of salty meadow wetland vegetation communities have been substantially impacted (i.e., in non-reference condition) and some portion of the approximately 1,013 acres of marsh and 1,025 acres of riparian vegetation communities have been impacted as a result of elk and bison abundance and distribution in the Park. Attempts to reduce the overconcentration of elk through management actions would be implemented to reduce the density of elk in these impacted wetland vegetation communities. Implementation of informed management actions would result in improved ecological integrity of wetland vegetation communities (i.e., improving the conditions of the approximately 2,644 acres of salty meadow wetlands in non-reference condition and improving riparian and marsh conditions).

When the active management of elk, is coupled with the complete removal of bison, increased cover and abundance of herbaceous wetland vegetation and increased height and canopy and survival of saplings in woody-species dominated would likely result in more wetland vegetation communities moving from non-reference to reference or better condition. ROMN WEI monitoring results would be used, within an adaptive management framework, to inform adaptive management actions (e.g., adding exclosures, focusing the location and intensity of elk management actions) intended to produce the desired trends in ecological integrity of the wetland vegetation communities.

Management actions to redistribute elk and reduce elk overconcentration, which include non-lethal hazing and lethal removal for dispersal, would be used across the different wetland vegetation communities that are being adversely impacted by ungulate use. Non-lethal and lethal actions utilizing horses across all of the wetland vegetation communities (or approximately 6,314 acres) has the potential to introduce exotic species through defecation of seeds of such plants by the horses. This could lead to the establishment or expansion of non-native plants that have the potential to outcompete and reduce abundance and cover of native plants in wetland vegetation communities. This risk would be greatly minimized through the requirement that all horses brought in for hazing be fed only weed-free hay. Non-lethal and lethal actions utilizing motorized vehicle could result in wetland vegetation impacts from the crushing of plants during any off-road vehicle use that could occur. These impacts would be managed by limiting motorized vehicle travel to existing roads to the maximum extent practicable. Impacts resulting from the frequency and duration of management actions would be limited to the timeframe of up to twice per week over one to four hours, avoiding the calving season (late May through early July) and severe winter (January through March). While the frequency could result in the impacts discussed above from weekly activities over six months of the year, the avoidance of management actions during calving would coincide largely with the growing season for many plants in the wetland vegetation communities; thereby, reducing the severity of the potential impacts.

Construction of up to 500 acres of additional exclosures under Alternative 2 could result in the localized loss of vegetation during fence construction. To quantify, using 500 acres as the potential area of all exclosures relates to a (total) fenceline perimeter of approximately 18,667 linear feet. Given a buffer of 10 feet beyond the perimeter of the fence to account for construction disturbances, the total area of potential impacts would be approximately 4.3 acres which is a small portion (approximately 0.068 percent) of the total 6,314 acres comprised of

wetland vegetation. Exclosures would be constructed as determined through ROMN WEI monitoring and guided through the adaptive management framework. The intent of the exclosures would be to protect wetland vegetation communities being impacted by ungulate disturbance. Therefore, although there would be some localized impacts to less than 1 percent of the wetland acreage, over the long-term there would be an improvement in the condition of up to 500 acres (or approximately 8 percent) of wetland vegetation. Impacts associated with the removal of the bison fence would be the same as those described under Alternative 1.

Overall, implementation of all management actions for the redistribution of elk (both lethal and non-lethal) and adherence to restrictions described above would limit adverse effects from active elk management in wetland vegetation communities both spatially and temporally. As a result, while there could be loss of individual plants in very limited areas, these areas would recover through natural growth over time and this loss would not result in permanently reduced wetland ecological condition. Implementation of research and monitoring and the adaptive management framework to inform management actions under Alternative 2 could allow for improved ecological integrity of wetland vegetation communities by reducing the number of sites in less than reference condition.

Cumulative Impacts. Adverse impacts on wetland vegetation communities under Alternative 2 from past and present actions would be similar to those described under Alternative 1 to include water diversion and groundwater pumping activities, agricultural activities on the Medano Ranch and former Baca Ranch (irrigation and mowing/baling of hay, grazing by domestic cattle and sheep), and big game hunting on adjacent lands, including the Baca NWR. Likewise, the beneficial impacts of exotic plant management would be the same as that described under Alternative 1. The adverse impacts from past and present actions, when combined with Alternative 2, which is more likely to result in beneficial impacts to vegetation than no action (as a result of removing bison from the landscape, a reduction in the overconcentration of elk, and adaptively managing for desired conditions), an overall beneficial cumulative impact would be expected to the wetland vegetation communities. Alternative 2 is expected to contribute a substantial beneficial increment to the overall cumulative impact on wetland vegetation communities.

Alternative 3

Under Alternative 3, TNC would continue to graze bison as a livestock herd on the Medano Ranch until government acquisition, at which time management of the bison herd would likely continue by TNC for 5–7 years under the same scenario. While the bison are still on the landscape, negative impacts from the current bison density of 0.03 to 0.05 bison per acre within the Medano Ranch, would likely continue, as described for Alternative 2.

Beneficial impacts resulting from elk management would be similar to those discussed under Alternative 2 (e.g., improved ecological integrity of wetland vegetation communities including approximately 1,013 acres of marsh, 1,025 acres of riparian, and approximately 2,644 acres of salty meadow wetlands) which entails the redistribution of elk from the current areas of overconcentration. A reduction in bison density after 5–7 years to 0.001 and 0.01 bison per acre as opposed to the current range of 0.03 to 0.05 bison per acre in the Park would result in

additional beneficial impacts when combined with the redistribution of elk by reducing the impacts that bison are currently having on the wetland vegetation communities.

The potential to expand the range and distribution of a wild bison herd on GRSA could create competition for forage in areas currently inaccessible to bison. It is expected bison would utilize habitats similar to those that are currently utilized. This could result in offtake of herbaceous plant species, increased compaction and erosion resulting from two large ungulates in salt flat, wet meadow, and riparian communities, spread of invasive species, and reduction in height, structure, and sapling survival in woody-dominated communities. However, the majority of these vegetation communities exist within the current impacted bison range so potential impacts to the wetland vegetation communities would be negligible from an expanded range. Furthermore, impacts from the expanded range could be beneficial if it resulted in reduced pressure in the currently over-used areas.

As with Alternative 2, ROMN WEI research and monitoring would inform adaptive management for desired conditions. Monitoring methods would attempt to identify the differences between how and where elk and bison are using the different vegetation communities to inform how to employ management actions to improve ecological integrity of the wetland communities being impacted. Data would be collected during the initial bison management phase (small number of bison) and over time would be coupled with longer-term data to inform and adjust, if necessary, bison density and abundance ranges to support the goals for wetland vegetation communities related to impacts from ungulates. Implementation of management actions and employing the adaptive management framework to meet desired conditions under Alternative 2 would help restore the ecological integrity of wetland plant communities.

Impacts from implementation of all management actions for the lethal removal or redistribution of elk, would be the same as those described under Alternative 2. Additional management actions under this alternative, such as bison roundup and removal, would involve driving bison to the existing handling facility on the Medano Ranch (Figure 7). The adverse impacts from roundup and removal would be similar to those for non-lethal hazing as the methodology for implementation would be similar (on horseback or motorized vehicle) to include crushing of plants and the potential to introduce invasive species. Additional impacts would occur through an increase in trampling and grazing (increased plant offtake and soil disturbance/compaction) along the round up the travel route. Roundups would generally occur infrequently; they are presently conducted no more than once annually, but would likely occur less frequently after NPS assumes management and the herd is managed as wildlife. The resulting impacts to vegetation would be minimal because of the short duration (a three-day time period per roundup) during which the roundup would occur and would be expected to recover before subsequent roundups were conducted.

Potential adverse impacts associated with the construction and removal of bison fencing would be limited to the localized loss of vegetation. These impacts would occur through loss of individual plants along the fence corridor and ground disturbance by equipment needed to install and remove fencing. Under the various fencing scenarios described in Chapter 2, "Fencing and Infrastructure," the affected area that would be impacted includes up to 4,180 linear feet of new fencing and removal of approximately 1,300 linear feet of fencing within wetland vegetation communities. Assuming a disturbance buffer of 10 feet on either side of the fencing alignment relates to an approximate disturbance area of 2.2 acres within wetland vegetation communities which is a small portion (approximately 0.035 percent) of the total 6,314 acres comprised of

wetland vegetation. Planning for fencing alignments would also take wetland vegetation into account and severe impacts would be avoided, to the extent possible, by adjusting the amount of and alignment of any fencing needed to achieve the desired vegetation management objectives. Impacts associated with enclosure fencing would be the same as those described under Alternative 2.

Overall, implementation of all management actions for the redistribution of elk (both lethal and non-lethal) and management of a lower density of bison in the Park and adherence to restrictions described above would limit adverse effects from Alternative 3 on wetland vegetation communities both spatially and temporally. As a result, while there could be a loss of individual plants in very limited areas; these areas would recover through natural growth over time and this loss would not result in permanently reduced wetland ecological condition. Implementation of research and monitoring and the adaptive management framework to inform management actions under Alternative 3 could allow for improved ecological integrity of wetland vegetation communities by reducing the number of sites in less than reference condition.

Cumulative Impacts. Adverse impacts on wetland vegetation communities under Alternative 3 from past and present actions would be similar to those described under Alternative 1 from water diversion and groundwater pumping activities, agricultural activities on the Medano Ranch and former Baca Ranch (irrigation and mowing/baling of hay, grazing by domestic cattle and sheep), and big game hunting on adjacent lands, including the Baca NWR. Likewise, the beneficial impacts of exotic plant management would be the same as that described under Alternative 1. The adverse impacts from past and present actions, when combined with Alternative 3, which is more likely to result in beneficial impacts to vegetation than no action (as a result of having a lower concentration of ungulates on the landscape and adaptively managing for desired conditions), an overall beneficial cumulative impact would be expected to the wetland vegetation communities. Alternative 3 is expected to contribute a substantial beneficial increment to the overall cumulative impact on wetland vegetation communities.

Alternative 4

Under Alternative 4, the redistribution of elk and the complete removal of bison in the Park for 5–7 years would result in similar beneficial impacts to wetland vegetation communities currently affected by overuse from ungulates, similar to those discussed under Alternative 2 (e.g., improved ecological integrity of wetland vegetation communities including approximately 1,013 acres of marsh, 1,025 acres of riparian, and approximately 2,644 acres of salty meadow wetlands).

Having no bison on the landscape for 5–7 years and the redistribution of elk from the areas of current overconcentration could allow for substantial recovery in the wetland vegetation communities that are currently in non-reference condition similar to that currently observed in the 18 acres of research enclosures with the exception of elk continuing to utilize these vegetation communities (though at a lower concentration). As discussed under Alternative 2, ROMN WEI research and monitoring would inform adaptive management for desired conditions. Data that would be collected during the initial phase while there are no bison on the landscape and over time would be coupled with longer-term data following the establishment of a low density bison herd. The data would inform management actions as well as adjustment of bison

density and abundance ranges so they support the goals for wetland vegetation communities. While there are no bison on the landscape, research and monitoring efforts would be able to better identify the differences between how and where elk and bison are impacting different vegetation communities. Adaptively managing to meet these desired conditions would help maintain the ecological integrity of these plant communities.

Impacts of elk management actions under this alternative would be the same as under Alternative 2 (i.e., crushing of plants, potential to introduce invasive species, enclosure fencing). The adverse effects to vegetation would be minimal because of the localization and short duration of management action impacts and the wetland vegetation communities would be expected to recover.

Impacts of bison management actions would be the same as under Alternative 3, (roundup, removal, fence removal/construction) with the exception that under Alternative 4, currently impacted wetland vegetation communities would have an opportunity to recover/improve during the 5–7 years with no bison.

Overall, implementation of all management actions for the redistribution of elk (both lethal and non-lethal) and management of a lower density of bison in the Park and adherence to restrictions described above would limit adverse effects from Alternative 4 on wetland vegetation communities both spatially and temporally. As a result, while there could be a loss of individual plants in very limited areas, these areas would recover through natural growth over time and this loss would not result in permanently reduced wetland ecological condition. Implementation of research and monitoring and the adaptive management framework to inform management actions under Alternative 4 could allow for improved ecological integrity of wetland vegetation communities by reducing the number of sites in less than reference condition.

Cumulative Impacts. Adverse impacts on wetland vegetation communities under Alternative 4 from past and present actions would be similar to those described under Alternative 1 to include water diversion and groundwater pumping activities, agricultural activities on the Medano Ranch and former Baca Ranch (irrigation and mowing/baling of hay, grazing by domestic cattle and sheep), and big game hunting on adjacent lands, including the Baca NWR. Likewise, the beneficial impacts of exotic plant management would be the same as that described under Alternative 1. The adverse impacts from past and present actions, when combined with Alternative 4, which is more likely to result in beneficial impacts to vegetation than no action (as a result of having a lower concentration of ungulates on the landscape and adaptively managing for desired conditions), an overall beneficial cumulative impact would be expected to the wetland vegetation communities. Alternative 3 is expected to contribute a beneficial increment to the overall cumulative impact on wetland vegetation communities.

IMPACTS TO ELK AND BISON

This impact topic addresses only elk and bison, and their associated habitat. The evaluation considers whether actions would be likely to displace some or all individuals of these species in the Park or would result in loss or creation of habitat conditions needed for the productivity of local or regional populations of elk and bison using all currently available information. The evaluation focuses on herd or population level effects. This analysis assumes that bison would be managed as livestock (as currently managed) prior to NPS acquisition of the Medano Ranch for all alternatives.

Alternative 1

Elk. Under Alternative 1, there would be no active elk management by the NPS, and no new actions would be applied to manage elk distribution in the Park. Elk overconcentration and high levels of herbivory would likely continue in some portions of their range (Schoenecker et al. 2012; Schweiger et al. 2017) (Figures 14 and 16). As described in the “Impacts to Wetland Vegetation” analysis for Alternative 1, degradation and lost ecological integrity in wetland vegetation communities would be expected to continue into the future. The decline or loss of vegetation production, and continued repression of woody cover reduces hiding, resting, and thermal cover for elk, which can lead to increased stress for individual elk and lower herd productivity over the long term (Johnson, Wisdom and Cook 2005). Roughly 1/3 of the sand sheet vegetation would likely remain in non-reference (Schweiger et al. 2017) and areas with intermediate or reference condition could decline (Tables 2 and 3; Figure 16). This would likely result in reduced forage quality and potentially reduced productivity for the herd over the long term. Elk densities would likely continue to be high in the core winter range and concentration areas under Alternative 1, which could result in high levels of intraspecific competition. Intraspecific competition for forage and cover can result in lowered fecundity, growth, or survival of competing individuals (Johnson et al. 2005; Townsend et al. 2008) and could have population effects, particularly in severe winters.

Currently, 18 exclosures exist in various locations throughout the Park (Figure 7). These exclosures adversely impact elk, in that they preclude elk from grazing at these sites while vegetation is recovering; however, the impacts are negligible because the total amount of unavailable habitat (approximately 18 acres) is small compared to total available habitat in the Park (6,314 acres in wetland vegetation communities alone).

Under this alternative, TNC would continue to graze bison as a livestock herd on the Medano Ranch until government acquisition, at which time the bison herd would be removed by TNC as a condition of land purchase. While bison remain on the landscape, elk-bison competition would continue. Removal of bison from the landscape following NPS acquisition of the Medano Ranch would eliminate elk-bison competition for local resources on 39,784 acres of land (of which 25,900 acres occur within GRSA’s legislative boundary), which could improve foraging opportunities for elk. As such, the local elk population and/or concentration on the Medano Ranch would likely increase in response to increased forage availability over time, and without

any tools to manage elk, elk overconcentration would likely continue and could increase stress for individual elk. This may eventually result in a decline in elk abundance and herd productivity.

Bison. Under Alternative 1, TNC would continue to manage for the existing bison herd as livestock until NPS acquires the Medano Ranch, at which point bison would be removed. Because there would be no active elk management while bison remain on the landscape, potential competition between elk and bison for local resources would continue. However, because bison would be removed upon acquisition, elk-bison competition and substantial decreases in habitat condition associated with ungulate overuse is not expected to occur beyond current conditions (i.e., no additional impacts) during the short period of time (pre-acquisition) that bison are expected to remain on the landscape. Therefore, Alternative 1 is expected to have no impact on the bison population.

Cumulative Impacts.

Elk – As shown in Table 7, several actions have the potential to combine with the effects of Alternative 1 to produce cumulative impacts on elk and elk habitat, including development of infrastructure for the Closed Basin Project, water diversion and groundwater pumping activities, construction and maintenance inside and outside of GRSA, and fire and exotic plant management. These actions have contributed to the current abundance, distribution, and movement of elk (as described in Chapter 3), as a result of altered habitat composition, loss of habitat connectivity, and/or loss or displacement from habitat due to increased human presence and noise associated with construction, maintenance, and resource management activities. Similarly, grazing by domestic cattle and sheep on the Baca and Medano-Zapata Ranches has resulted in changes in native vegetation, which has altered habitat composition and forage quality.

Though the actions involved in fire and exotic plant management result in disturbances to elk and elk habitat (e.g., increased human presence and noise while they are implemented; and habitat loss that occurs until vegetation returns), fire and exotic plant management ultimately support and enhance ecosystem structure, composition, and function that would improve foraging opportunities in the Park. Similarly, future restoration of native plant communities on the Medano Ranch from active invasive species management and reseeding would also improve habitat and foraging opportunities for elk on the Medano Ranch, which could reduce browsing pressure in other areas of the Park.

Big game hunting on adjacent lands, including the elk hunting on Baca NWR could impact elk and elk habitat by resulting in more elk seeking refuge in the Park. In the absence of active elk management in the Park, more elk in the Park could increase intraspecific competition for forage and cover, resulting in lowered fecundity, growth, or survival of competing individuals (Townsend et al. 2008) and could have population effects, particularly in severe winters.

Past, present, and future actions in and around GRSA have resulted and would continue to result in primarily adverse impacts to elk and elk habitat from habitat loss/degradation and species disturbance, with minimal benefits from habitat restoration and improved foraging opportunities in certain areas of the Park (as described above). These impacts, when combined with the adverse impacts of continued elk overconcentration and the indirect beneficial impacts of bison removal under Alternative 1, are expected to result in an overall adverse cumulative impact on elk and elk habitat, with some indirect benefits from limited habitat restoration and

increased foraging opportunities. The incremental impacts of Alternative 1 would contribute slightly to, but would not substantially change, the impacts that are already occurring.

Bison – There would be no cumulative impacts on the existing bison population as no impacts would result from the no-action alternative.

Alternative 2

Elk. Actions taken to redistribute the herd are expected to improve habitat quality in areas that are currently overbrowsed—including the 2,644 acres of salty meadow wetland vegetation communities that have been impacted as a result of elk and bison abundance and distribution in the Park (Schweiger et al. 2017). Hazing alone does move elk temporarily, but is labor intensive and unlikely to redistribute elk for long periods of time as elk eventually habituate to hazing activities (Walter et al. 2010). Based on local efforts by CPW and USFWS, hazing in combination with lethal removal optimizes dispersal effectiveness. Effective dispersal of elk in the Park and onto surrounding lands could allow wetland vegetation communities to recover as described in the “Impacts to Wetland Vegetation” section, resulting in improved ecological conditions and increased quantity and quality of forage. It is important to note that it could take 3–10 years of dispersal activities before movement toward desired conditions is observable. Increased survival of woody species and canopy height in cottonwood and willow dominated riparian communities would increase the availability of hiding, resting and thermal cover for elk. Increased dispersal and decreased elk density in the Park could also decrease intraspecific competition. The improved habitat quality, combined with reduced elk density and intraspecific competition could support herd productivity and reproductive potential over the long term.

Additional enclosure fencing under Alternative 2 would exclude elk from specific areas in the Park (no more than 500 acres), which would prevent elk from foraging in some of the more productive areas of the Park (wetland vegetation communities) while vegetation is recovering, but the overall reduction in forage would be a small compared to total available habitat in the Park (6,314 acres in wetland vegetation communities alone). Eventually, allowing these areas the opportunity to recover, would improve forage quality and quantity available to elk once the fences are removed.

Active management tools associated with dispersal (i.e., hazing and lethal removal for dispersal) would disrupt and displace individual elk and groups of elk. It is assumed that over the life of the plan, approximately 35 percent of GRSA’s predicted wintering elk population (or approximately 2,000 elk) would be permanently impacted by these efforts. This is based on NPS’s goal of reducing the wintering elk population within the Park from 75 percent to 40 percent of the total DAU population during the life of this plan, as described in Chapter 2. The objective is to move large groups of animals quickly and efficiently over a sufficient distance to discourage animals from returning to over-browsed habitat. Use of horses, motorized vehicles, helicopter, etc. would have similar effects and result in increased movement and stress for individual elk. Elk moving to off-site areas could also be subject to hunting and increased mortality. However, this is consistent with the objectives of this alternative. Based on input from CPW, lethal removal would result in the direct mortality of 40–200 elk per year, with the long-term goal of reducing the wintering elk population in GRSA to 40 percent of the total DAU elk population. Lethal removal would be used predominantly during hunting seasons in an effort to

disperse elk from the Park and onto adjacent lands, but could occur anytime starting in late July through late December. Additional lethal removal actions could occur during later months but would be prescribed in consideration of animal welfare. Hazing would not be used during calving season and while the calves are still very young or during severe winter (January through March) to minimize animal welfare issues. The timing and frequency of these redistribution actions would be evaluated and adjusted through monitoring and adaptive management.

As described in Chapter 2, Alternative 2 would include additional elk distribution monitoring and data collection to guide long-term management of elk population levels, which could include winter classification flights, use of radio-telemetry and/or standardized ground counts, and other remote monitoring techniques. These activities could result in impacts similar to those described above for hazing activities—disturbance and increased stress to individual animals. Radio-telemetry studies require capture and handling of individual elk (up to 60 animals over a period of 3 to 5 years) for short periods of time over the life of the plan (to replace/refurbish collars, if needed) resulting in stress and possible inadvertent injury or death. Standardized ground counts can increase elk vigilance and stress in individual elk or groups due to increased human presence. Winter classification flights would generally occur once per year (no more than three times), with each flight lasting approximately 6–8 hours, and would, therefore, not result in long-term effects of the herd. None of these activities would occur during calving season or severe winter to minimize animal welfare issues.

If bison are still on the landscape, the current habitat condition and trends created by elk and bison foraging would likely improve and interspecific competition would likely be reduced, as active elk management would encourage redistribution from areas of overconcentration. Removal of approximately 1,700 bison from the landscape following NPS acquisition of the Medano Ranch would eliminate elk-bison competition for local resources on 39,784 acres of land (of which 25,900 acres occur within GRSA's legislative boundary), which could result in increased and improved foraging opportunities for elk. Improved forage quantity and quality could support long-term productivity of the elk herd. Improved habitat conditions could also attract additional elk to the Park or retain individuals and groups for longer periods of time, potentially limiting the habitat benefits of bison removal.

Overall, effective dispersal of elk under Alternative 2 could allow wetland vegetation communities to recover, resulting in improved habitat quality and ecological integrity by increasing the quantity and quality of forage. Increased survival of woody species and canopy height would increase the availability of hiding, resting and thermal cover for elk. Additional habitat improvements for elk are expected from the removal of bison from the landscape. The improved habitat quality compared to Alternative 1, combined with reduced elk density and competition (both intraspecific and interspecific) could support herd productivity and reproductive potential over the long term (3–10 years). While actions associated with active elk management (hazing, fencing, lethal removal for dispersal) would result in increased disturbance and stress for individual animals, and the direct mortality of up to 200 individual elk each year, these impacts would not affect the viability of the population.

Bison. Alternative 2 involves a continuation of current management for bison until NPS acquisition of the Medano Ranch, at which time TNC would remove the bison herd as a condition of the purchase. If bison are still on the landscape when active elk management begins, there could be indirect impacts to bison from management actions including increased

stress from human disturbance, displacement from preferred habitat and increased movement. The redistribution and removal of up to 40–200 elk per year could also improve habitat conditions for bison, as described above for elk. Effective dispersal of elk in the Park and onto surrounding lands could allow for recovery of wetland vegetation and improved ecological integrity, increasing the quantity and quality of forage available for bison while they remain on the landscape. However, acquisition of the Medano Ranch and removal of bison, would likely occur before any improvements to habitat and ecological condition would be observed. Similarly, it is possible that bison are removed from the Medano Ranch prior to implementation of any active elk management. In this case, elk management actions under Alternative 2 would not have impacts on the existing bison herd.

Cumulative Impacts.

Elk – As described for Alternative 1, past, present, and future actions in and around GRSA have resulted and would continue to result in primarily adverse impacts to elk and elk habitat from habitat loss/degradation and disrupting and displacing elk, with minimal benefits from habitat restoration and improved foraging opportunities in certain areas of the Park. These impacts, when combined with the limited potential adverse impacts of active elk management, as well as the likely benefits of elk redistribution and bison removal under Alternative 2, are expected to result in an overall beneficial cumulative impact on elk from improved habitat and foraging opportunities. The incremental impacts of Alternative 2 would contribute substantially, the impacts that are already occurring.

Bison – As shown in Table 7, some actions have the potential to combine with the effects of Alternative 2 to produce cumulative impacts on bison in the Park, including water diversion and groundwater pumping activities. Former grazing by domestic cattle and sheep and agricultural activities on the Medano Ranch have altered vegetation communities and habitat composition in the Park. However, agricultural activities irrigate the meadows for the intended purpose to increase forage for the existing livestock bison herd.

Other actions that could impact bison include big game hunting on adjacent lands, including the elk hunting on the Baca NWR, which could have resulted in more elk seeking refuge in the Park. More elk in the Park has increased interspecific competition for forage and cover, and likely contributes to further habitat degradation. However, production of hay and forage on the Medano Ranch likely offsets the past and present adverse impacts of interspecific competition from elk likely seeking refuge in the Park as a result of elk hunting on adjacent lands.

Future restoration of native plant communities on the Medano Ranch from active invasive species management and reseeding would have no impact on bison under Alternative 2, as this action would not occur until the NPS acquires the Medano Ranch, and bison would no longer be on the landscape at that time.

While bison remain on the landscape, past, present, and future actions in and around GRSA have resulted and would continue to result in some adverse impacts to bison from past changes in habitat composition and interspecific competition with elk likely seeking refuge in the Park. These impacts would be limited because they are largely offset by irrigation activities on the Medano Ranch that have produced hay and forage for the existing bison herd, and would not persist once bison are removed. These impacts, when combined with the likely minimal adverse

impacts of Alternative 2, are expected to result in overall very limited adverse cumulative impacts on bison while they remain on the landscape.

Alternative 3

Elk. The impacts of active elk management would be the same under Alternative 3 as those described under Alternative 2. Effective dispersal of elk in the Park and onto surrounding lands could allow as much as 2,644 acres of salty meadow wetland vegetation communities the opportunity to recover, resulting in improved ecological conditions and increased quantity and quality of forage. Increased survival of woody species and canopy height would increase the availability of hiding, resting and thermal cover for elk as well. These improved habitat conditions combined with reduced intraspecific competition could support long-term herd productivity and reproduction potential.

As described for Alternative 2, additional enclosure fencing would exclude elk from specific areas in the Park (no more than 500 acres), which would prevent elk from foraging in some of the more productive areas of the Park (wetland vegetation communities) while vegetation is recovering, but the overall reduction in forage would be a small compared to total available habitat in the Park (6,314 acres in wetland vegetation communities alone). Eventually, allowing these areas the opportunity to recover, would improve forage quality and quantity available to elk once the fences are removed.

As described for Alternative 2, active management tools associated with dispersal (i.e., hazing and lethal removal for dispersal) would disrupt and displace individual elk and groups of elk resulting in increased movement and stress and the direct mortality of 40–200 elk per year (from lethal removal). It is assumed that over the life of this plan, approximately 2,000 elk (or 35 percent of GRSA's predicted wintering population) would be permanently impacted by these dispersal efforts. Elk moving to off-site areas could also be subject to hunting and increased mortality. Activities associated with long-term monitoring (e.g., winter classification flights, use of radio-telemetry and/or standardized ground counts) could result in impacts similar to those described above for hazing activities—disturbance and increased stress to individual animals and possible inadvertent injury or death. As described for Alternative 2, hazing or disruptive monitoring activities would not be used during calving season and while the calves are still very young (late May through July) to minimize animal welfare issues. The timing and frequency of these redistribution actions would be evaluated and adjusted through monitoring and adaptive management.

Although bison would remain on the landscape following NPS acquisition of the Medano Ranch, there would be a substantial reduction in the bison herd (e.g., 25–50 bison would remain) at the conclusion of 5–7 years that would reduce interspecific competition in areas where bison and elk currently use the same habitat. Reduced competition could further improve foraging opportunities for elk and support long-term productivity of the elk herd. Roundup of bison could increase stress and temporarily alter elk herd behavior and movements. However, because the bison herd would be managed initially at a very low density, it is not expected that these actions would be needed for several years (following initial reduction) and would occur on a very infrequent basis thereafter.

The potential to establish and expand the range and distribution of a bison herd in the Park would likely alter the locality of interspecific competition between elk and bison. Bison would be able to roam across up to an additional 32,000 acres where no bison currently exist (Figure 7), which could result in competition between elk and bison in new locations of the Park. Bison foraging and trampling in these new areas could also impact elk habitat, however, even within the expanded bison range the bison herd would be managed at a much lower density than current conditions (i.e., 0.001 and 0.01 bison per acre, potentially resulting in 80–580 bison eventually, versus the current condition of 0.03 to 0.05 bison per acre), likely resulting in marginal adverse impacts to elk and elk habitat.

As described under Alternative 2, improved habitat conditions from active elk management and bison herd reduction could also attract additional elk to the Park or retain individuals and groups for longer periods of time, potentially limiting some of the habitat benefits of bison reduction.

Overall, effective dispersal of elk under Alternative 3 could allow wetland vegetation communities to recover, resulting in improved habitat quality and ecological integrity by increasing the quantity and quality of forage. Increased survival of woody species and canopy height would increase the availability of hiding, resting and thermal cover for elk. Additional habitat improvements for elk are expected from the substantial reduction in the number of bison on the landscape. The improved habitat quality compared to Alternative 1, combined with reduced elk density and competition (both intraspecific and interspecific) could support long-term productivity. While actions associated with active elk management (hazing, fencing, lethal removal for dispersal) would result in increased disturbance and stress for individual animals and the direct mortality of 40–200 individual elk each year (from lethal take), these impacts would not affect the viability of the population.

Bison. Under Alternative 3, the NPS would manage a bison herd within a density range of 0.001 and 0.01 bison per acre in the Park. Following a 5–7 year period after NPS acquisition of the Medano Ranch, GRSA would work with a partner to reduce the bison herd from approximately 1,700 to less than 50 (e.g., 25–50), representing the lower end of the density range within the existing bison fence (i.e., 0.001 bison per acre across 26,000 acres). This would reduce potential intraspecific and interspecific competition over that 5- to 7-year time frame, which could result in improved foraging opportunities for the remaining bison.

Following the 5–7 year transition period, the NPS plans to re-establish (from another DOI bison conservation herd) and manage a bison herd of 25–260 bison in the existing fence or 80–580 within a potentially expanded range (Figure 7). Although the herd could grow to 580 bison, this still represents a substantial reduction compared to the current herd size; therefore, it is expected that reduced overall competition and improved foraging opportunities would continue following the initial 5–7 year transition period. Bison would further benefit from increased foraging opportunities if the bison range is expanded within the life of the plan.

The primary tools to be used by the NPS to manage a bison herd within the preferred density range would be fencing, roundup and translocation of live bison, and lethal removal. Roundup could involve providing feed to attract bison to an area suitable for handling, driving the bison into corrals from horseback or vehicles and processing for transport. Roundup and processing activities could result in harassment, increased stress on individual animals, and/or result in injury or death. Lethal removal would also result in the death and possible inadvertent injury of a few other individuals. However, the purpose of these activities would be to maintain the bison

population size within the proposed density range to help meet desired conditions. For both roundup and lethal removal activities, increased stress could temporarily alter herd behavior and movements. However, because the bison herd would be managed initially at a very low density, it is expected that these actions would not be needed for several years (following initial reduction) and would occur on a very infrequent basis thereafter, as roundup and lethal removal would only be implemented when vegetation monitoring indicates that vegetation condition in the Park is declining due to excessive herbivory and grazing.

Additional enclosure fencing under Alternative 3 would exclude elk and bison from specific areas in the Park, allowing these areas the opportunity to recover, which could benefit bison habitat by improving forage quality and quantity over the long term (3–10 years). Over the short term the enclosures would prevent bison from foraging in some of the more productive areas of the Park (wetland vegetation communities), but the overall reduction (up to 500 acres) in access to forage in the enclosure would be a small percentage of the total forage available in the Park. Interior or perimeter fencing to keep bison within suitable areas and prevent movement onto neighboring private lands would restrict bison movement and possible access to forage and other resources. This could result in excessive grazing and habitat degradation in areas accessible to bison within the Park. Installation of fencing could temporarily displace bison during construction.

Indirect adverse effects to bison could result from disturbance during elk hazing activities and lethal removal of elk, including increased stress from human disturbance, displacement from preferred habitat, and increased movement. However, impacts from these activities would be temporary; lasting from several hours per week to several days depending on the activity. Hazing by helicopter or fixed-wing aircraft would occur up to twice per winter (each, for a total of four possible flights) with flight times ranging from one to two hours. The redistribution and removal of 40–200 elk per year in the Park could allow for recovery of wetland vegetation and improved ecological condition, increasing habitat quality and the quantity of forage available for bison.

As described in Chapter 2, Alternative 3 could include additional elk distribution monitoring and data collection to guide long-term management of elk population levels, which could include winter classification flights, use of radio-telemetry and/or standardized ground counts, and other remote monitoring techniques. Similar techniques could be used to monitor bison as well. These activities could result in impacts similar to those described above for hazing activities: increased stress, movement, and displacement. However, winter classification flights would generally occur once per winter, with each flight lasting approximately 6–8 hours.

Overall, Alternative 3 could result in both adverse and beneficial impacts to bison and bison habitat. Tools used to manage the bison population could result in harassment and injury or direct mortality of individual bison. Similar indirect adverse impacts (increased stress from human disturbance, displacement from preferred habitat and increased movement) could result from tools used to actively manage the elk population in the Park. However, the intent of these actions would be to maintain the populations within a density range that allows GRSA to meet desired conditions and improve forage quantity and quality available to bison. Bison would likely benefit over the long term from the redistribution of elk across the landscape and the subsequent improvements to habitat and ecological integrity. Improved and increased foraging opportunities for the bison herd would likely result from reduced intraspecific and interspecific

competition. Bison would further benefit from increased foraging opportunities if the bison range is expanded within the life of the plan.

Cumulative Impacts.

Elk – As described for Alternative 1, past, present, and future actions in and around GRSA have resulted and would continue to result in primarily adverse impacts to elk and elk habitat from habitat loss/degradation and species disturbance, despite some habitat restoration and improved foraging opportunities in certain areas of the Park. These impacts, when combined with the limited potential adverse impacts of active elk management, as well as the likely benefits of elk redistribution and bison reduction under Alternative 3, are expected to result in an overall beneficial cumulative impact on elk from improved habitat and foraging opportunities. Alternative 3 is expected to contribute a substantial beneficial increment to the overall cumulative impact on elk.

Bison – As shown in Table 7, some actions have the potential to combine with the effects of Alternative 3 to produce cumulative impacts on bison in the Park, including water diversion and groundwater pumping activities. Former grazing by domestic cattle and sheep and agricultural activities on the Medano Ranch have altered vegetation communities and habitat composition in the Park. However, agricultural activities on the Medano Ranch also irrigate the meadows, providing additional forage for the existing bison herd.

Other actions that could impact bison include big game hunting on adjacent lands, including the elk hunting on the Baca NWR, which may have resulted in more elk seeking refuge in the Park. More elk in the Park has increased interspecific competition, which could limit forage availability and cover for the bison herd. However, active elk management under Alternative 3 could redistribute elk from areas of overconcentration in the Park and potentially discourage some elk from seeking refuge in the Park.

Future restoration of native plant communities on the Medano Ranch from active invasive species management and reseeding would support native vegetation growth, thus, improving native habitat conditions and forage quality for bison.

Past, present, and future actions in and around GRSA have resulted and could continue to result in some adverse impacts to bison from past changes in habitat composition and interspecific competition with elk likely seeking refuge on Park/Medano Ranch lands. These impacts are limited because they have largely been offset by irrigation activities on the Medano Ranch that have produced hay and forage for the existing bison herd. While hay and forage would no longer be produced following acquisition of the Medano Ranch, the substantial reduction of bison on the landscape and potential range expansion under Alternative 3 would eliminate the need for supplemental forage. The impacts of past, present, and future actions, when combined with the overall beneficial impacts of Alternative 3, are expected to result in an overall beneficial cumulative impact on bison, despite some limited adverse impacts to individual bison. Alternative 3 is expected to contribute a substantial beneficial increment to the overall cumulative impact on bison and bison habitat. Because bison would remain on the landscape under Alternative 3, cumulative effects to bison would be ongoing when compared to the cumulative effects of Alternative 2.

Alternative 4

Elk. The impacts of non-lethal and lethal elk management would be the same under Alternative 4 as those described for Alternative 2. Effective dispersal of elk in the Park and onto surrounding lands could allow as much as 2,644 acres of wetland vegetation communities the opportunity to recover, resulting in improved ecological conditions and increased quantity and quality of forage. These improved habitat conditions combined with reduced interspecific competition could support long-term herd productivity and reproduction potential. Additional exclosure fencing would allow recovery of some of the more productive areas of the Park (wetland vegetation communities) likely improving forage quality and quantity over the long term (3–10 years). The short-term reduction in elk access to forage within exclosures (up to 500 acres) would be a small compared to the total forage available in the Park (6,314 acres in wetland vegetation communities alone). Allowing these areas within the fence exclosures the opportunity to recover would eventually improve forage.

Use of horseback, motorized vehicles, helicopter, etc. would have similar effects and result in increased movement and stress, and the direct mortality of up to 40–200 elk per year (from lethal removal). It is assumed that over the life of this plan, 2,000 elk (or 35 percent of GRSA's predicted wintering population) would be permanently impacted by these dispersal efforts. As described for Alternative 2, hazing and monitoring activities would not be used during calving season and while the calves are still very young (late May through July) or during severe winter (January through March) to minimize animal welfare issues.

The initial removal of bison from the landscape after Park acquisition would likely benefit the local elk population by removing interspecific competition and reducing herbivory on the Medano Ranch. The absence of bison on the landscape for 5–7 years, combined with active elk management to encourage dispersal could benefit native habitat and allow overgrazed areas the opportunity to recover. Reduced competition and improved foraging opportunities could support long-term productivity of the elk herd. As described for Alternatives 2 and 3, potentially improved habitat conditions could also attract additional elk to the Park or retain individuals and groups for longer periods of time, possibly limiting the benefits of bison removal.

Once a bison herd is established, increased interspecific competition and the effects of bison range expansion would likely be similar to impacts described under Alternative 3, except that habitat conditions would likely be different. Overall, competition between elk and bison under Alternative 4 would be less than current conditions because of fewer bison on the landscape. Ultimately, the impacts of establishing a bison herd after a period of 5–7 years following acquisition would depend on multiple variables. Therefore, the impacts of bison and elk together on the landscape, and their response to active management would be monitored and evaluated at that time. Roundup of bison, once a herd is established, could increase stress and temporarily alter elk herd behavior and movements. However, because the bison herd would be managed initially at a very low density, it is not expected that these actions would be needed for several years (following initial reduction) and would occur on a very infrequent basis thereafter.

Overall, effective dispersal of elk under Alternative 4 could allow recovery of wetland vegetation communities, resulting in improved habitat quality and ecological integrity by increasing the quantity and quality of forage. Increased survival of woody species and canopy height would increase the availability of hiding, resting and thermal cover for elk. Similarly, initial removal of bison from the landscape would remove a source of interspecific competition, and would further

contribute to habitat improvements. The improved habitat quality compared to Alternative 1, combined with reduced elk density and competition (both intraspecific and interspecific) could support long-term productivity and reproductive potential for the elk herd. While actions associated with active elk management (hazing, fencing, lethal removal for dispersal) would result in increased disturbance and stress for individual animals and the direct mortality of 40–200 individual elk each year (from lethal take), these impacts would not affect the viability of the population.

Bison. Alternative 4 involves a continuation of current management for bison until NPS acquisition of the Medano Ranch, at which time TNC would remove the bison herd as a condition of the purchase. Once a bison herd is established in the Park after a 5- to 7-year time period, the direct impacts of tools used to manage the bison population (e.g., hazing, fencing, roundup, lethal removal) would be the same as those described under Alternative 3. Roundup and lethal removal of bison could result in harassment, increased stress on individual animals, and/or in the death and possible inadvertent injury of a few other individuals. However, the purpose of these activities would be to maintain the bison population size within the proposed density range to help meet desired conditions. For both roundup and lethal removal, increased stress could temporarily alter herd behavior and movements; however, by starting with a very low density herd, it is not expected that these actions would be needed for several years and would occur on a very infrequent basis. Roundup and lethal removal would only be implemented when ROMN WEI monitoring indicates that vegetation condition in the Park is declining due to ungulate disturbances.

As described for Alternative 3, additional enclosure fencing would exclude bison from specific areas in the Park, allowing these areas the opportunity to recover, and potentially improving forage quality and quantity for bison over the long term (3–10 years). Over the short term, the enclosures would prevent bison from foraging in some of the more productive areas of the Park (wetland vegetation communities), but the overall reduction (no more than 500 acres) in access to forage would be a small percentage of the total forage available in the Park. Interior or perimeter fencing to keep bison within suitable areas and prevent movement onto neighboring private lands would restrict bison movement and possible access to forage and other resources. This could result in excessive grazing and habitat degradation in areas accessible to bison within the Park; however, impacts would likely be minimal, as the bison herd would be established at a much lower density (and across a larger area) than what currently exists on the landscape. Installation of fencing could temporarily displace bison during construction.

As described for Alternatives 2 and 3, indirect adverse effects could also result from disturbance during elk hazing activities and lethal removal of elk, including increased stress from human disturbance, displacement from preferred habitat and increased movement of animals. However, it is difficult to determine how often these activities would occur after 5–7 years, when a herd is re-established in the Park. In addition, the anticipated result of these management activities, the redistribution and removal of 40–200 elk per year in the Park, could improve habitat conditions and forage available for bison from enhanced ecological integrity. Additional benefits could result if the bison range is expanded within the life of the plan. However, expansion of the bison range is dependent on many variables, including funding, and is difficult to predict.

Cumulative Impacts.

Elk – As described for Alternative 1, past, present, and future actions in and around GRSA have resulted and would continue to result in primarily adverse impacts to elk and elk habitat from habitat loss/degradation and species disturbance, with minimal benefits from habitat restoration and improved foraging opportunities in certain areas of the Park. These impacts, when combined with the adverse impacts of active elk management, as well as the potential benefits of elk redistribution and initial bison removal under Alternative 4, are expected to result in an overall beneficial cumulative impact on elk, with short-term adverse impacts to individual elk from harassment/hazing activities and lethal removal. Alternative 4 is expected to contribute to a substantial beneficial increment to the overall cumulative impact on elk.

Bison – The cumulative impacts under Alternative 4 would be similar to those described for Alternative 3, with a slightly greater beneficial effect from the initial removal of bison from the landscape for a period of 5–7 years following NPS acquisition of the Medano Ranch. Alternative 4 is expected to contribute to a substantial beneficial increment to the overall cumulative impact on bison.

IMPACTS TO WILDERNESS CHARACTER

The analysis for impacts on wilderness character focuses on changes that would result from the proposed management actions on the untrammeled, undeveloped, and natural qualities of the wilderness areas. NPS Management Policies (NPS 2006) states that all wilderness categories, including suitable, study, proposed, recommended, and designated, shall be treated as wilderness; thus, all categories of wilderness are considered in this analysis (see Figure 21).

Alternative 1

As described in Chapter 3, the Park is year-round habitat for elk, which use the sand sheet grasslands, shrublands, dunefield, and subalpine forest life zones (NPS 2007). Areas to the west and north of the dunefield are winter concentration areas, and, with the exception of the dunefield, the majority of the Park is severe winter range (CPW 2016a). The resident population area occurs in both proposed wilderness and non-wilderness (Figure 21). Unmanaged elk populations are consistent with the natural and untrammeled values of wilderness. However, continued lack of elk management and overconcentration of elk in certain areas (Figure 14) would result in continued degradation of native habitat and wetland vegetation communities within wilderness (15 of the 33 wetland sites monitored by ROMN that are in less than reference condition [as depicted on Figure 16], occur in wilderness), which would adversely impact the natural quality of wilderness character in those areas over the long term.

Elk, bison, and vegetation research and monitoring in the Park can adversely affect the untrammeled quality of wilderness from the presence of exclosures (currently there are 18 [or 18 acres], all of which occur in wilderness) or the use of motorized vehicles on access areas of interest. However, these monitoring efforts support the long-term establishment of a more naturally-functioning ecosystem, which would improve the natural quality of wilderness by supporting the desired conditions described in Chapter 1.

The removal of bison from the wilderness portions of the Medano Ranch following NPS acquisition could degrade the natural quality of wilderness in those areas (approximately 16,300 acres out of 128,654 acres total wilderness), as it would involve the removal of a native herbivore from the landscape. However, removal of bison from the landscape could also benefit other aspects of the natural quality of wilderness over the long term (3–10 years) if native plant communities recover in areas on the Medano Ranch that are in less than reference condition and ecological conditions trend toward improvement. The removal of the existing bison fence (approximately 6.9 miles within wilderness) would benefit undeveloped and untrammelled qualities of wilderness in the affected areas.

Overall, the no-action alternative would adversely affect the untrammelled, undeveloped, and natural qualities of wilderness character in GRSA; however, any potential impacts would be limited to small areas of wetland habitat and vegetation. Removal of bison from the landscape could result in both adverse and beneficial impacts to the naturalness of wilderness character in the Park. There would likely be no impacts to wilderness in the Preserve from the no-action alternative, because most of the elk concentration areas do not occur in the Preserve (due to habitat, topography and existing hunting pressure) and the majority of existing management actions occur in the Park.

Cumulative Impacts. Past and present actions in wilderness include the existence of infrastructure such as access roads and fencing, and ongoing management of vegetation and other resources. These actions have contributed, though minimally in proportion to the size of the wilderness area (which is approximately 86 percent of GRSA land), to impacts to the untrammelled and undeveloped qualities of wilderness character in GRSA.

The planned restoration of native riparian plant communities on the Medano Ranch would benefit the natural qualities of wilderness in that area. No other reasonably foreseeable future actions have been identified that would affect wilderness character in GRSA. These impacts, when combined with the limited adverse impacts of Alternative 1 described above, are expected to result in an overall adverse cumulative impact on the untrammelled and undeveloped qualities, and may compromise the benefits to natural qualities from riparian habitat restoration. The incremental impacts of Alternative 1 would contribute slightly to, but would not substantially change, the impacts that are already occurring.

Alternative 2

Active elk management tools include non-lethal hazing (including use of noisemakers, firearms, motorized vehicles, and helicopters) and lethal removal, and could occur in wilderness various times throughout the year. Hazing and lethal removal activities could impact the untrammelled, undeveloped, and natural qualities of wilderness by introducing new and more aggressive forms of modern human control and manipulation, and by influencing natural ecosystem processes (altering elk concentration and distribution). However, these activities would not be ongoing—lethal removal would occur for up to four weeks and non-lethal hazing would occur up to twice per week for a period of five months—therefore, the impacts of these actions on wilderness character would be temporary. Hazing by motorized vehicle and aircraft would also impact the undeveloped quality of wilderness, while doing so by horseback would have a smaller effect because it is not motorized. Although motorized vehicle use is a prohibited use

based on Section 4 (c) of the Wilderness Act, a minimum requirements analysis to document the determination of whether any prohibited uses are necessary to meet minimum requirements for the administration of the area as wilderness would be conducted. Although active elk management actions can adversely impact the undeveloped, untrammeled, and natural qualities of wilderness character, the expected result of elk redistribution (i.e., recovery of native vegetation and improved ecological condition in wilderness) would benefit the natural quality of wilderness character over the long term (3–10 years).

The use of noisemakers, firearms, motorized vehicles, helicopters and fixed-wing aircraft in or over wilderness would undoubtedly disturb the natural sounds and quiet in the Park that contribute to the primitive recreation quality of wilderness. These impacts would typically occur in locations that are far from most areas frequented by backcountry visitors, which could minimize interference with opportunities for solitude. Closures required for management actions could affect primitive and unconfined recreation. In general, these disturbances would be temporary, occurring up to twice per week for up to a period of five months (late July to late December). Hazing by helicopter or fixed-wing aircraft would occur up to twice per winter (each, for a total of four possible flights) with flight times ranging from one to two hours. Helicopter use for elk winter classification flights would generally occur only once per year, with each flight lasting 6–8 hours. Sounds of gunshots would be instantaneous and not inconsistent with wilderness because hunting is allowed in wilderness.

The impacts from elk, bison, and vegetation research and monitoring would be the same under Alternative 2 as those described for Alternative 1. Similar impacts would result if future enclosure fencing occurs in wilderness (which is likely since approximately 86 percent of GRSA is designated and proposed wilderness). Impacts to untrammeled qualities would result from fencing structures that are intended to manipulate and control ecological systems. Impacts to undeveloped qualities would result from the presence of the enclosures or the use of motorized vehicles to access areas of interest. However, it is assumed that up to 500 acres would be enclosed during the life of this plan, which represents 0.004 percent of total wilderness in GRSA. In addition, these monitoring efforts support the long-term establishment of a more naturally-functioning ecosystem (including redistribution of elk across the landscape and reduced impacts of herbivory), which would improve the natural quality of wilderness by supporting the desired conditions described in Chapter 1.

The removal of bison from the wilderness portions of the Medano Ranch following NPS acquisition could degrade the natural quality of wilderness in those areas (approximately 16,300 acres out of 128,654 acres total wilderness), as it would involve the removal of a native herbivore from the landscape. However, as stated for Alternative 1, removal of bison from the landscape could also benefit other aspects of the natural quality of wilderness over the long term (3–10 years) if native plant communities recover in areas on the Medano Ranch that are in less than reference condition and ecological conditions trend toward improvement. Like Alternative 1, the removal of the existing bison fence (approximately 6.9 miles) would benefit undeveloped and untrammeled qualities of wilderness in the affected areas.

Overall, Alternative 2 could adversely impact wilderness values (untrammeled, undeveloped, natural, and opportunities for solitude and primitive recreation) in the Park, from tools used to actively manage and disperse the elk population on an infrequent and intermittent basis. Though actions associated with active elk management could adversely impact wilderness character, which is a fundamental resource at GRSA, the impacts are not expected to be

significant, as they would not degrade the value of this resource over the long term. Any adverse impacts to wilderness values are expected to occur in isolated or small areas relative to the total area of wilderness in GRSA (i.e., 128,654 acres). In addition, elk management actions in wilderness that involve a prohibited use would be reviewed in a minimum requirements analysis, and would be allowed to proceed only if it is determined that the minimum level of activity and disruption of wilderness qualities would be used. Alternative 2 would also benefit the natural quality of wilderness in the Park by redistributing the elk herd and removing bison from the landscape, which would reduce impacts of ungulate use in areas of wilderness where wetland vegetation communities are degraded.

Cumulative Impacts. As described for Alternative 1, past and present actions in wilderness include the existence of infrastructure such as access roads and fencing, and ongoing management of vegetation and other resources. These actions have contributed, though minimally in proportion to the size of the wilderness (which is approximately 86 percent of GRSA land), to impacts to the untrammled and undeveloped qualities of wilderness character in GRSA. The planned restoration of native riparian plant communities on the Medano Ranch would benefit the natural qualities of wilderness in that area.

These impacts of past, present, and reasonably foreseeable actions, when combined with the adverse and beneficial impacts of Alternative 2 described above, are expected to result in an overall adverse cumulative impact to the untrammled, undeveloped, natural, and primitive qualities of wilderness in the Park. Those cumulative impacts, however, are expected to be minimal and would be subject to a minimum requirements analysis prior to implementation. Some cumulative benefits to the natural quality would result from redistribution of the elk herd and removal of bison from the landscape, combined with riparian habitat restoration.

Alternative 3

The impacts of active elk management (non-lethal hazing and lethal removal for dispersal) under Alternative 3 would be the same as those described for Alternative 2, with impacts to the untrammled, developed, natural, and primitive recreation qualities of wilderness, as well as natural sounds and quiet. Like Alternatives 1 and 2, ungulate and vegetation research and monitoring, including enclosure fencing, could adversely affect the untrammled and undeveloped qualities of wilderness, yet benefit the natural quality of wilderness by supporting the desired conditions described in Chapter 1.

The construction of any new bison fencing along the outer edge of proposed wilderness (approximately 35 miles of additional fencing associated with range expansion) following acquisition of the Medano Ranch and possible range expansion for bison could adversely affect the untrammled and undeveloped qualities of wilderness in the Park during construction, from the noise of construction activities (i.e., mechanized/motorized equipment) and the presence of structures and installations that are intended to manipulate or control ecological systems in wilderness. Only 3,967 feet (3/4 mile) of potential future drift fencing would occur in wilderness. Since all of the new bison fencing along the west and north boundaries of the bison area would be located along the outer edge of the wilderness, that impact would be minimal and would be limited to the fence construction period. Over the long term, approximately 6.9 miles of fencing

would be removed under Alternative 3, resulting in a benefit to the untrammled and undeveloped qualities of the wilderness character.

Bison would be incorporated into park management under this alternative, and any actions taken to manage the bison herd (e.g., hazing, roundup, lethal removal) would have impacts to the untrammled and natural qualities similar to those described for elk. These actions would be subject to a minimum requirements analysis for actions in wilderness. Expanding the bison range in the Park at a level of abundance and density that is consistent with historic occurrences of bison could contribute to the natural quality of wilderness by restoring a native species. Bison, as a native herbivore, could play a beneficial role in the maintenance of meadow and wetland ecosystems through grazing and foraging (if overall ungulate numbers and concentrations are sustainable). Incorporating bison into park management and wilderness could provide park visitors with more bison-viewing opportunities in backcountry areas, contributing to the primitive recreation quality of wilderness.

Overall, Alternative 3 would adversely impact wilderness values (untrammled, undeveloped, natural, and opportunities for solitude and primitive recreation) in the Park, from tools used to actively manage and disperse the elk population on an infrequent and intermittent basis. Though actions associated with active elk management could adversely impact wilderness character, which is a fundamental resource at GRSA, the impacts are not expected to be significant, as they would not degrade the value of this resource over the long term. Any adverse impacts to wilderness values are expected to occur in isolated or small areas relative to the total area of wilderness in GRSA (i.e., 128,654 acres). In addition, actions involving prohibited uses to manage elk and bison in wilderness would be reviewed in a minimum requirements analysis, and would be allowed to proceed only if it is determined that the minimum level of activity and disruption of wilderness qualities would be employed. Alternative 3 would also benefit the natural quality of wilderness in the Park by redistributing the elk herd and reducing the number of bison on the landscape, and reducing impacts of ungulate use in areas of wilderness where wetland vegetation communities are degraded (as much as 2,644 acres). In addition, benefits to wilderness character (natural) could result from incorporating bison into park management, especially if GRSA were to expand the bison range in the Park.

Cumulative Impacts. As described for Alternative 1, past and present actions in wilderness include the existence of infrastructure such as access roads and fencing, and ongoing management of vegetation and other resources. These actions have contributed, though minimally in proportion to the size of the wilderness (which is approximately 86 percent of GRSA land), to impacts to the untrammled and undeveloped qualities of wilderness character in GRSA. The planned restoration of native riparian plant communities on the Medano Ranch would benefit the natural qualities of wilderness in that area.

The impacts of past, present, and reasonably foreseeable actions, when combined with the adverse and beneficial impacts of Alternative 3 described above, are expected to result in an overall adverse cumulative impact to the untrammled, undeveloped, natural, and primitive qualities of wilderness in the Park. Those cumulative impacts, however, are expected to be minimal and would be subject to a minimum requirements analysis prior to implementation. Some cumulative benefits to the natural quality would result from redistribution of the elk herd and incorporating bison into park management at reduced numbers, combined with the benefits of riparian habitat restoration.

Alternative 4

The impacts of active elk management (non-lethal hazing and lethal removal for dispersal) under Alternative 4 would be the same as those described for Alternatives 2 and 3, with impacts to the untrammled, developed, natural, and primitive recreation qualities of wilderness, as well as natural sounds and quiet. Like Alternatives 2 and 3, ungulate and vegetation research and monitoring, as well as enclosure fencing, could adversely affect the untrammled and undeveloped qualities of wilderness, and also benefit the natural quality of wilderness by supporting the desired conditions described in Chapter 1.

The initial removal of bison from the wilderness portions of the Medano Ranch following NPS acquisition could degrade the natural quality of wilderness in those areas (approximately 16,300 acres out of 128, 654 acres of total wilderness), as it would involve the removal of a native herbivore from the landscape. However, the initial removal of bison from the landscape would also reduce ungulate use impacts in degraded habitat within wilderness and further encourage the redistribution of elk (from reduced competition), thus, potentially contributing to the natural quality of wilderness in the Park by promoting naturally functioning ecological systems.

Under Alternative 4, incorporating a new conservation bison herd into park management 5–7 years following acquisition is likely to result in the same effects on wilderness character as described for Alternative 3. Adverse impacts to the untrammled and undeveloped qualities could result from actions taken to manage the herd, including fencing; however, any actions taken to manage the bison herd that include prohibited uses in wilderness would be subject to a minimum requirements analysis. Over the long term (3–10 years), incorporating a conservation herd and expanding their range on the landscape at a level of abundance and density that is consistent with the abundance and density of historic occurrences of bison could contribute to the natural quality of wilderness in the Park by restoring a native species. Bison, as a native herbivore, could play a beneficial role in the maintenance of meadow and wetland ecosystems through grazing and foraging (if overall ungulate numbers and concentrations are sustainable).

Overall, Alternative 4 would adversely impact wilderness values (untrammled, undeveloped, natural, solitude, and primitive recreation) in the Park, from tools used to actively manage and disperse the elk population on an infrequent and intermittent basis. Though actions associated with active elk management could adversely impact wilderness character, which is a fundamental resource at GRSA, the impacts are not expected to be significant, as they would not degrade the value of this resource over the long term. Any adverse impacts to wilderness values are expected to occur in isolated or small areas relative to the total area of wilderness in GRSA (i.e., 128, 654 acres). In addition, actions involving prohibited uses to manage elk and bison in wilderness would be reviewed in a minimum requirements analysis, and would be allowed to proceed only if it is determined that the minimum level of activity and disruption of wilderness qualities would be used. Alternative 4 would also benefit the natural quality of wilderness in the Park by redistributing the elk herd and initially removing bison from the landscape, and reducing impacts of ungulate use in areas of wilderness where wetland vegetation communities are degraded. In addition, benefits to wilderness character (natural) could result from incorporating a conservation bison herd into park management, especially if GRSA were to expand the bison range in the Park.

Cumulative Impacts. As described for Alternative 1, past and present actions in wilderness include the existence of infrastructure such as access roads and fencing, and ongoing

management of vegetation and other resources. These actions have contributed, though minimally in proportion to the size of the wilderness (which is approximately 86 percent of GRSA land), to impacts to the untrammeled and undeveloped qualities of wilderness character in GRSA. The planned restoration of native riparian plant communities on the Medano Ranch would benefit the natural qualities of wilderness in that area. These impacts, when combined with the adverse and beneficial impacts of Alternative 4 described above, are expected to result in an overall adverse cumulative impact to the untrammeled, undeveloped, natural, and primitive qualities of wilderness in the Park. Those cumulative impacts, however, are expected to be minimal and would be subject to a minimum requirements analysis prior to implementation. Some cumulative benefits to the natural quality would result from redistribution of the elk herd and incorporating bison into park management at reduced numbers in the future, combined with the benefits of riparian habitat restoration.

IMPACTS TO ARCHEOLOGICAL RESOURCES

This impact topic focuses only on impacts to archeological resources. Archeological resources are the most common cultural resource in GRSA and most susceptible to potential effects from the proposed alternatives. Archeological resources in the Park include prehistoric (Native American) and historic (post A.D. 1821) period sites. The analysis for archeological resources considers the potential to impact archeological resources in two areas of concern. These include: up to 40 miles of proposed fence alignments (with a 50-foot buffer on either side) that would constitute a new ground disturbing activity with the potential to affect resources, and the larger valley floor within the Park that would encompass the maximum extent of ungulate range (within the Park) under the proposed alternatives.

Alternative 1

Under the no-action alternative, no active elk management would occur in the Park and no bison would remain on the Medano Ranch following NPS acquisition. Overconcentration of ungulates contributes to near surface sediment erosion, which can expose archeological sites and contribute to the loss of physical integrity, and lead to illicit artifact collection by the public. Loss of physical integrity from erosion and the loss of artifacts affect the ability of archeological properties to convey significance and to contribute information important to the interpretation of prehistory. Some of the most important archeological properties in the Park are located in areas of ungulate overconcentration, including wetlands and along streams.

Once bison are removed from the Medano Ranch prior to NPS acquisition, archeological sites that may have been affected by overconcentration in areas where bison are located could stabilize over time through natural revegetation and sediment deposition, thus preventing future impacts from bison. The initial effect from bison overconcentration may be irretrievable and it is possible that elk concentration could increase in areas where bison no longer graze, potentially preventing previously impacted archeological sites from stabilizing over time. Because of the lack of available data, it would be speculative to estimate the number, density and location of the 347 known archeological sites that may have been impacted by overconcentration and which may have suffered irretrievable effects.

Overall, it is assumed that Alternative 1 would likely diminish the potential of archeological sites to provide information significant to the interpretation of prehistory and/or history as a result of trampling and erosion associated with elk overconcentration; though, the effects to specific properties at GRSA cannot be further qualified or quantified without further study. Though historic resources are not considered fundamental to the purpose and significance of GRSA, they are considered important, and further study is necessary to evaluate the past and present effects of ungulate overconcentration on archeological properties in GRSA by assessing the effects of trampling and the degree of subsequent erosion and artifact breakage.

Cumulative Impacts. As shown in Table 7, some actions have the potential to combine with the effects of Alternative 1 to produce cumulative impacts on archeological resources in GRSA, including fire management, water diversion and habitat conversion to support bison on the Medano Ranch, grazing by domestic cattle and sheep on the Baca and Medano-Zapata Ranches, and road and utility construction and maintenance. These actions have the potential to directly impact historic properties through ground-disturbing activity.

Past actions associated with the San Luis Valley-Closed Basin Project and ground disturbing activity within the boundaries of the Park were avoided by identification of historic properties and by implementing mitigation or avoidance measures. The construction of Closed Basin Project infrastructure such as the 170 salvage wells, 132 observation wells, 115 miles pipeline laterals and 42 miles of conveyance channel may have impacted known and unknown archeological properties but at present those impacts cannot be quantified. However, the determination of the Colorado SHPO was no adverse effect on historic properties indicating that impacts did not occur.

Grazing by domestic cattle and sheep on the Baca and Medano-Zapata Ranches has likely resulted in impacts to archeological resources within and adjacent to the Park, though, it is unknown the extent of these impacts. As described above for Alternative 1, ungulates contribute to near surface sediment erosion, which can expose archeological sites and contribute to the loss of physical integrity, and lead to illicit artifact collection by the public. Loss of physical integrity from erosion and the loss of artifacts affect the ability of archeological properties to convey significance and to contribute information important to the interpretation of prehistory. However, past and present federal actions have been subject to compliance with Section 106 of the NHPA, which includes an effort to identify historic properties in areas proposed for ground disturbance, avoidance where feasible, and minimization or mitigation of direct effects where avoidance is not feasible. GRSA has been successful at avoiding adverse effects to historic properties by implementing avoidance measures for past and present actions.

Additional actions that could impact archeological resources include utility relocation and ground disturbing activity associated with habitat restoration. It is assumed that these ground-disturbing actions would avoid archeological properties through identification and implementation of avoidance measures. With the implementation of avoidance measures, the reasonably foreseeable actions are likely to have no effect on cultural resources. Properties of significance to Native American tribes on the Medano Ranch would be avoided through on-going consultation.

The potential adverse impacts of past, present, and foreseeable future federal actions described above have been or would be limited by implementation or avoidance measures resulting from compliance with Section 106 of the NHPA. These impacts, when combined with the adverse

impacts of continued elk overconcentration and the indirect beneficial impacts of bison removal under Alternative 1, are expected to result in adverse cumulative impacts on archeological resources from the potential for future erosion from elk overconcentration, with potential benefits from removing bison from the landscape.

Alternative 2

Under Alternative 2, GRSA would implement active elk management, including hazing and additional enclosure fencing, as well as lethal removal for dispersal. Construction of additional enclosure fencing could pose a potential direct adverse effect on archeological properties, but the effects would be minimized or entirely mitigated through avoidance and monitoring measures. Identification surveys would be undertaken prior to fence construction to ensure that historic properties are avoided; monitoring would take place during fence construction to ensure that inadvertent effects to historic properties would not occur.

The indirect benefit of redistributing GRSA's elk population over a larger geographic area would be reduced elk concentrations in areas of overuse, which would minimize any potential effects that may be occurring to archeological properties from prolonged trampling, such as erosion and artifact breakage. The redistribution of elk also distributes effects to archeological properties over a larger area thereby minimizing the overall adverse effect.

As described for Alternative 1, removal of bison would eliminate any future impacts from bison trampling and exposing sites to erosion, thereby minimizing the loss of integrity and information recovery potential.

Cumulative Impacts. As shown in Table 7, some actions have the potential to combine with the effects of Alternative 2 to produce cumulative impacts on archeological resources in GRSA, including fire management, the development of infrastructure for the Closed Basin Project, water diversion and habitat conversion to support bison on the Medano Ranch, grazing by domestic cattle and sheep on the Baca and Medano-Zapata Ranches, and road and utility construction and maintenance. The impacts of these actions would be the same as those described for Alternative 1: these actions have the potential to directly impact historic properties through ground-disturbing activity. As described for Alternative 1, past, present, and foreseeable future federal actions have or would be subject to compliance with Section 106 of the NHPA, which includes an effort to identify historic properties in areas proposed for ground disturbance, avoidance where feasible, and minimization or mitigation of direct effects where avoidance is not feasible. GRSA has been successful avoiding adverse effects to historic properties by implementing avoidance measures for past and present actions. Similarly, future actions would avoid archeological properties through identification and implementation of avoidance measures.

The impacts of past, present, and future actions, when combined with the beneficial impacts of reduced elk overconcentration and trampling, and bison removal under Alternative 2, are expected to result in an overall beneficial cumulative impact to archeological resources. Any potential adverse effects to archeological properties would be minimized by conducting an archeological survey to identify properties and adjusting enclosure fencing alignments to avoid archeological properties. Alternative 2 would contribute a slight beneficial increment to the overall cumulative impact.

Alternative 3

Effects from active elk management under Alternative 3 would be the same as described under Alternative 2: redistribution of elk from hazing and other methods would have a beneficial effect on archeological properties by reducing elk concentration in areas of overuse, which would minimize any potential effects that may be occurring to archeological properties from prolonged trampling, such as erosion and artifact breakage. The redistribution of elk also distributes effects to archeological properties over a larger area thereby minimizing the overall adverse effect. This could support natural stabilization of archeological sites over the long term and preservation of information significant to the interpretation of prehistory or history. As noted under Alternative 2, effects from the construction of fencing and enclosures would be minimized through identification efforts and avoidance measures.

As described in Chapter 2, Alternative 3 includes continued management of bison on the Medano Ranch for 5–7 years following NPS acquisition, at which point the NPS would assume responsibility of bison management within the recommended density range. Effects to archeological properties from bison remaining in the Park would be similar to those identified for elk under Alternative 1 (i.e., trampling and erosion) for the first 5–7 years following acquisition. However, the long-term impacts of bison management are expected to be minimal, as the substantial reduction in the number of bison from the current herd would largely alleviate on-going adverse effects from bison overconcentration in archeologically sensitive areas by reducing the area affected by trampling and erosion. Effects from proposed bison fencing would be the same as those described for enclosure fencing under Alternative 2 and would be minimized using the same methodology. While archeological properties are an important resource (though, not fundamental to the purpose and significance of GRSA), overall, bison management under Alternative 3 would not diminish the ability of archeological properties in the Park to convey significance and to contribute information important to the interpretation of prehistory.

Cumulative Impacts. As shown in Table 7, some actions have the potential to combine with the effects of Alternative 3 to produce cumulative impacts on archeological resources in GRSA, including fire management, the development of infrastructure for the Closed Basin Project, water diversion and habitat conversion to support bison on the Medano Ranch, grazing by domestic cattle and sheep on the Baca and Medano-Zapata Ranches, and road and utility construction and maintenance. The impacts of these actions would be the same as those described for Alternative 1: these actions have the potential to directly impact historic properties through ground-disturbing activity. As described for Alternative 1, past, present, and foreseeable future federal actions have been or would be subject to compliance with Section 106 of the NHPA, which includes an effort to identify historic properties in areas proposed for ground disturbance, avoidance where feasible, and minimization or mitigation of direct effects where avoidance is not feasible. GRSA has been successful at avoiding adverse effects to historic properties by implementing avoidance measures for past and present actions. Similarly, future actions would avoid archeological properties through identification and implementation of avoidance measures.

Although bison would remain on the landscape under Alternative 3, the impacts from potential trampling and overconcentration are expected to be negligible, as the reduction in the number of bison from the current herd would partially alleviate on-going adverse effects from

overconcentration in archeologically sensitive areas, by reducing the area affected by erosion. Any potential adverse effects to archeological properties would be minimized by conducting an archeological survey to identify properties and adjusting enclosure fencing alignments to avoid archeological properties. Therefore, the potential adverse impacts of past, present and future actions, when combined with the overall beneficial impacts of reduced elk overconcentration and bison density under Alternative 3 would likely result in an overall beneficial cumulative effect. Alternative 3 would contribute a slight beneficial increment to the overall cumulative impact.

Alternative 4

Effects from active elk management under Alternative 4 would be the same as described under Alternative 2: redistribution of elk from hazing and other methods would have a beneficial effect on archeological properties by reducing elk concentrations in areas of overuse, which would minimize any potential effects that may be occurring to archeological properties from prolonged trampling, such as erosion and artifact breakage. The redistribution of elk also distributes effects to archeological properties over a larger area thereby minimizing the overall adverse effect. This could support natural stabilization of archeological sites over the long term and preservation of information significant to the interpretation of prehistory or history. As noted under Alternative 2, effects from the construction of fencing and enclosures would be minimized through identification efforts and avoidance measures. Bison roundups would also temporarily increase the potential for trampling of surface archeological sites as they are herded towards the corral.

As described in Chapter 2, a low density bison herd would be incorporated into park management 5–7 years following NPS acquisition of the Medano Ranch. Initial removal of bison from the landscape would contribute beneficial effects by eliminating potential impacts to archeological properties from bison trampling and exposing sites to erosion, thereby further minimizing the loss of integrity and information recovery potential. Following introduction of a conservation bison herd, effects to archeological properties from bison would be similar to those identified for elk under Alternative 1 (i.e., trampling and erosion) as bison exhibit similar behavior and tend to overconcentrate in archeologically sensitive areas. However, incorporating a lower density herd than what currently exists would partially alleviate and minimize on-going adverse effects from potential overconcentration in archeologically sensitive areas. The effects on archeological properties from bison roundups could be adverse if archeological properties are present. Effects from proposed bison fencing would be the same as those described for enclosure fencing under Alternative 2 and would be minimized using the same methodology.

Cumulative Impacts. Effects from cumulative impacts under Alternative 4 would be similar to those described for Alternatives 2 and 3. As shown in Table 7, some actions have the potential to combine with the effects of Alternative 4 to produce cumulative impacts on archeological resources in GRSA, including fire management, the development of infrastructure for the Closed Basin Project, water diversion and habitat conversion to support bison on the Medano Ranch, grazing by domestic cattle and sheep, and road and utility construction and maintenance. The impacts of these actions would be the same as those described for Alternative 1: these actions have the potential to directly impact historic properties through ground-disturbing activity. As described for Alternative 1, past, present, and foreseeable future federal actions have been or would be subject to compliance with Section 106 of the NHPA, which includes an effort to

identify historic properties in areas proposed for ground disturbance, avoidance where feasible, and minimization or mitigation of direct effects where avoidance is not feasible. GRSA has been successful at avoiding adverse effects to historic properties by implementing avoidance measures for past and present actions. Similarly, future actions would avoid archeological properties through identification and implementation of avoidance measures.

Under Alternative 4, bison would be initially be removed from the landscape and then reestablished on the landscape after 5–7 years following NPS acquisition of the Medano Ranch, resulting in similar impacts as those described for Alternative 3. Like Alternative 3, the ultimate reduction in the number of bison under Alternative 4 would partially alleviate potential adverse effects from bison trampling and overconcentration in archeologically sensitive areas, by reducing the area affected by erosion. In addition, any potential adverse effects to archeological properties would be minimized by conducting an archeological survey to identify properties and adjusting enclosure fencing alignments to avoid archeological properties. Therefore, the potential adverse impacts of past, present and future actions, when combined with the overall beneficial impacts of reduced elk overconcentration and bison density under Alternative 4 would likely result in an overall beneficial cumulative effect on archeological resources. Alternative 3 would contribute a slight beneficial increment to the overall cumulative impact.

IMPACTS TO SOCIOECONOMICS: GAME DAMAGE

As described in Chapter 1, this impact topic focuses on game damage potential for agricultural fields. Management actions that are intended to alter distribution, movement, and behavior of elk in the Park may cause elk to redistribute in unexpected ways, including redistribution onto agricultural fields resulting in an increase in the potential for game damage.

Alternative 1

Under the no-action alternative, the potential for game damage resulting from the local elk population would be expected to increase as there would be no actions to reduce the elk herd in the Park.

Removing bison from the landscape upon acquisition of the Medano Ranch, would result in less competition for forage initially but the local elk population would likely increase in response to increased forage availability offsetting any benefit from the removal of bison. Elk in the Park are presumed to be drawn to the irrigated agricultural fields during from late spring to late summer; therefore, an increase in the number of elk in the Park would result in an increase in the game damage potential on adjacent agricultural fields in DAU E-11 or neighboring DAUs (such as DAU E-55) (Figure 2) as commercially grown crops include alfalfa, spinach, lettuce, potatoes, and small grains are forage that attract elk. Because of the threat that game damage causes to agricultural activities in DAU E-55, the population objective for elk in the DAU is zero. The presence of elk in a field increases the potential for the spread of crop diseases into a seed potato field which would substantially lower the value of that crop. Any elk migrating from the Park onto agricultural lands could result in an adverse effect both to the farmers whose crops and infrastructure could be damaged as well as CPW's Game Damage Program as it would increase the financial liability of administering the program.

The potential for increased game damage associated with elk in the Park presents a unique and unknown risk as it is difficult to predict the level to which increased concentrations of elk in the Park could increase game damage on neighboring agricultural fields. Any increase in game damage potential would be significant as it would be inconsistent with the efforts of CPW and local HPPs to manage conflicts between elk and agricultural land uses.

Cumulative Impacts. Legal hunting of elk contributes cumulative impacts to game damage issues. CPW is currently trying to maximize the elk harvest in DAU E-11 and adjacent DAUs through license/hunter distribution and creation of special seasons to meet population objectives. For instance, in DAU-55, because of the potential for substantial impacts related to game damage, the CPW has an elk population objective of zero and special hunting seasons have been created that occur throughout the year. CPW is also working with the USFWS on the Baca NWR to make the elk more available to hunters in attempts to decrease the elk population (CPW 2010) and reduce impacts associated with elk on the landscape.

Though the past and present actions described above have likely resulted in a reduction of game damage potential by reducing overall elk numbers, the reduction has not been successful in eliminating the threat and, as such, continuation of these actions should not be relied upon as the only means to solve the issues around game damage. Impacts from implementation of hunting on the Baca NWR have not yet been quantified but could result in beneficial impacts on the game damage potential if it results in a decrease in the number of elk on the landscape. Alternatively, it could result in adverse impacts if it results in redistribution of elk into adjacent agricultural fields. For Alternative 1, the significant adverse impacts from the uncontrolled elk population when combined with the minimal beneficial effects of other cumulative actions would be expected to result in a significant adverse cumulative impact. Alternative 1 would result in a substantial adverse increment to the overall cumulative impact.

Alternative 2

As described under Alternative 1, with the removal of bison from the landscape following NPS acquisition of the Medano Ranch, elk would face less competition for forage. However, under Alternative 2, elk management actions would focus on redistributing elk from the forage opportunities in the areas of current overconcentration. These elk management actions, intended to alter distribution, movement, and behavior of elk in the Park, could cause elk to redistribute in unexpected ways, including redistribution onto agricultural fields (Figures 2 and 10) resulting in an increase in game damage from either physical damage to crops, fields, or infrastructure, or the spread of disease. Alternatively, if elk management action were to result in more elk being harvested during hunting season resulting in a reduction of overall numbers of elk then the result would be a decrease in game damage potential. Lethal removal would result in the culling of 40–200 elk annually as a means of redistributing the elk. Similarly to non-lethal redistribution actions, this action could result in either adverse or beneficial impacts to game damage potential: adverse if elk redistribute outside of the Park and onto adjacent fields and beneficial if the resultant decrease in the elk population were sufficient to decrease the game damage potential.

The potential for increased game damage associated with elk in the Park presents a unique and unknown risk as it is difficult to predict elk movement outside the Park following implementation

of Alternative 2, which could increase game damage on neighboring agricultural fields. Any increase in game damage potential would be significant as it would be inconsistent with the efforts of CPW and local HPPs to manage conflicts between elk and agricultural land uses.

The potential for adverse impacts would be minimized by working with partners, such as CPW, to coordinate hunting and dispersal efforts outside the Park with elk management actions within the Park. Redistribution efforts would focus on moving elk to areas where they could be legally hunted and not in the direction of agricultural lands. However, if elk redistribute and overconcentrate in undesirable areas, which includes neighboring agricultural lands, then redistribution efforts would cease immediately and the NPS would coordinate with partner entities to correct the situation. These actions would not occur from late May through July which encompasses a large portion of the growing season for many crops such as potatoes in the San Luis Valley (Colorado State University Extension 2008).

Cumulative Impacts. Cumulative impacts on game damage potential under Alternative 2 would be similar to those described under Alternative 1 with the exception that if redistribution efforts were successful then more elk would be available for harvest where hunting is legal. For Alternative 2, when the beneficial impacts of having only one ungulate on the landscape and a redistributed and reduced elk population are further combined with the effects of other cumulative actions (elk population reduction through legal hunting), an overall beneficial cumulative impact would be expected resulting in a reduction in game damage potential.

Alternative 3

Impacts associated with the substantial reduction of the number of bison on the landscape under Alternative 3 would not differ measurably from the complete removal of bison on the landscape in terms of game damage potential. It is unknown if proposed expansion of the bison range and increased competition for forage in areas currently inaccessible to bison would result in elk moving into the surrounding agricultural fields. The competition for forage could make the surrounding irrigated agricultural fields more attractive and increase the game damage potential. This result is unlikely as the areas where there is currently an overconcentration of elk are generally contained inside the bison fence and not in areas that are currently inaccessible to bison. Therefore, expanding the territory available to bison outside of the current bison fence would not be expected to influence how and where elk distribute and subsequently, would not have any impact on game damage potential.

Overall, impacts from game damage under this alternative would be similar to those described under Alternative 2 (beneficial if elk are redistributed and harvested; adverse if redistribution efforts result in more elk moving onto agricultural fields) and measures to reduce impacts (cessation of hazing if elk move to undesirable locations) would be similarly applied. A resultant decrease in game damage potential would be significant to CPW's Game Damage Program as it would reduce the financial liability of administering the program as well as funding required to implement prevention measures. Alternatively, any increase in game damage potential would be significant as it would be inconsistent with the efforts of CPW and local HPPs to manage conflicts between elk and agricultural land uses.

Cumulative Impacts. Cumulative impacts on game damage potential under Alternative 3 would be similar to those described under Alternative 2. When the potential beneficial impacts from

Alternative 3 based on successful redistribution of elk for harvest where hunting is legal is combined with the effects of other cumulative actions (elk population reduction through legal hunting), an overall beneficial cumulative impact would be expected through the reduction of the overall elk population resulting in a reduction in game damage potential.

Alternative 4

Alternative 4 differs from Alternative 3 in that bison would be removed completely from the landscape for 5–7 years while elk management actions would be the same. Though the bison range could be expanded, the overall lower density of bison would result in less competition for forage between elk and bison and could minimize the number of elk that might be drawn to irrigated agricultural fields surrounding the Park.

Overall, impacts associated with the complete removal of bison followed by introduction of a low density bison herd on the landscape would not differ measurably from Alternative 3. The potential for game damage to crops, fields, and infrastructure would be the same (beneficial if elk are redistributed and harvested; adverse if redistribution efforts result in more elk moving onto agricultural fields) and measures to reduce impacts (cessation of hazing if elk move to undesirable locations) would be applied in the same manner. A resultant decrease in game damage potential would be significant to CPW's Game Damage Program as it would reduce the financial liability of administering the program as well as funding required to implement prevention measures. Alternatively, any increase in game damage potential would be significant as it would be inconsistent with the efforts of CPW and local HPPs to manage conflicts between elk and agricultural land uses.

Cumulative Impacts. Cumulative impacts on game damage potential under Alternative 4 would be the similar to those described under Alternative 3 (dependent on successful redistribution of elk for harvest where hunting is legal) with the exception that potential impacts resulting from competition for forage between elk and bison would be delayed for 5–7 years. When the potential beneficial impacts from Alternative 4 (redistribution of elk for harvest where hunting is legal) is combined with the effects of other cumulative actions (elk population reduction through legal hunting), an overall beneficial cumulative impact would be expected through the reduction of the overall elk population resulting in a reduction in game damage potential.

Chapter 4: Environmental Consequences

CHAPTER 5: Consultation and Coordination



CHAPTER 5: CONSULTATION AND COORDINATION

The intent of the NEPA is to encourage the participation of federal and state involved agencies and affected citizens in the assessment procedure, as appropriate. This section describes the consultation that occurred during development of this UMP/EIS, including consultation with scientific experts and other agencies. This chapter also includes a description of the public involvement process and a list of the recipients of the draft and final UMP/EIS.

SCOPING PROCESS

The NPS divides the scoping process into two parts: internal scoping and external or public scoping. Internal scoping involved discussions among NPS personnel regarding the purpose of and need for management actions, issues, management alternatives, mitigation measures, the analysis boundary, appropriate level of documentation, available references and guidance, and other related topics.

Public scoping is the early involvement of the interested and affected public in the environmental analysis process. The public scoping process helps ensure that people have an opportunity to comment and contribute early in the decision-making process. For this planning document and impact statement, project information was distributed to individuals, agencies, and organizations early in the scoping process, and people were given opportunities to express concerns or views and to identify important issues or even other alternatives.

Taken together, internal and public scoping are essential elements of the NEPA planning process. The following sections describe the various ways scoping was conducted for this impact statement.

Internal Scoping

A two-day internal scoping meeting was held June 3 and 4, 2009 at GRSA to identify the purpose, need, and objectives for the action, identify issues related to the action, determine the proper NEPA pathway, discuss a range of preliminary alternatives, and identify data needs. Representatives from GRSA, USFWS, USFS (also representing the BLM), the NPS Environmental Quality Division (EQD), Weston Solutions, Inc., and ERO Resources Corporation were all in attendance. The results of the meetings were captured in a report that can be accessed at the NPS's Planning, Environment and Public Comment (PEPC) website (<http://parkplanning.nps.gov/grsa-ungulates>).

In addition, GRSA has coordinated with many technical experts prior to starting the planning process and established a Science Team to provide input to this plan. Comprised of subject matter experts, the Science Team advised and provided technical recommendations to the NPS on matters regarding scientific data and analysis. The team met periodically providing technical background information and research references for this plan. The team participants were limited to persons with scientific background in ungulate management, research, and range ecology; NPS staff; and others with background experience with GRSA or San Luis Valley ecosystems.

Public Scoping

The public scoping process began on November 4, 2011 with the publication of a Notice of Intent in the Federal Register (FR) (FR, Volume 76, Issue 214). The NPS hosted two public scoping meetings in the vicinity of GRSA in support of this effort. Public service announcements were provided to local television and radio news agencies and local newspapers, and an announcement was posted on the NPS's web-based comment forum, Planning, Environmental, and Public Comment (PEPC), to notify the public of these meetings. Approximately 100 public scoping newsletters were also distributed by mail. These meetings were conducted on November 14 and 15, 2011.

The NPS hosted two additional meetings in the fall of 2014 to present a range of preliminary alternative concepts for public review. A 60-day public comment period was announced beginning on September 3, 2014. The NPS hosted two public meetings on September 16 and 17, 2014 in the vicinity of GRSA to present the preliminary alternative concepts and potential management tools and solicit feedback on a range of questions developed specifically on these topics. Public service announcements were provided to local television and radio news agencies and local newspapers, and an announcement was posted on PEPC, to notify the public of these meetings. Approximately 100 preliminary draft alternatives newsletters were also distributed by mail.

All public meetings took place between 6:00 p.m. and 8:00 p.m., and were organized in an open-house format, allowing the public to browse informational posters, interact with park staff, and listen to a brief presentation at their own pace. A series of full-color display boards was presented to help illustrate the project vicinity and background, and an overview of ungulates at GRSA. These display boards also provided an overview of the NEPA process. Park and other NPS staff, and contractors were located at the display boards to answer questions; facilitate discussions; and record thoughts, ideas, and concerns raised by the public. Meeting locations and dates are listed in Table 8.

Table 8. Public meetings

Meeting Date and Time	Meeting Location
Monday, November 14, 2011, from 6:00 to 8:00 p.m.	Alamosa Recreation Center, Alamosa, Colorado
Tuesday, November 15, 2011, from 6:00 to 8:00 p.m.	Baca Grande POA Meeting Hall, Crestone, Colorado
Tuesday, September 16, 2014, from 6:00 to 8:00 p.m.	Baca Grande POA Meeting Hall, Crestone, Colorado
Wednesday, September 17, 2014, from 6:00 to 8:00 p.m.	Alamosa Recreation Center, Alamosa, Colorado

During each open house, the NPS offered brief slideshow presentations defining the proposed timeline of the project, background of the Park, current wildlife management strategies, and the purpose, need and objectives of the UMP/EIS as well as the preliminary range of alternatives during the second set of meetings. During each meeting, the public was offered a variety of opportunities to provide feedback or submit questions, including flip charts, comment forms (and drop box), and pre-addressed comment forms for postal delivery. Participants were given information regarding accessing PEPC, and were encouraged to submit their comments electronically using this system. The addresses for submitting comments were printed on all news releases and the project newsletter for the benefit of people who could not attend the open houses, but still wanted to provide comments.

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A total of 16 pieces of correspondence were received during the scoping period and 17 during the preliminary draft alternatives comment period by mail or electronically through PEPC and email. Following the public scoping periods, the NPS reviewed all public comments and a Comment Analysis Report was developed to compile and correlate similar public comments into a format useable by the decision-makers and the planning team. The Comment Analysis Report provides assistance in organizing, clarifying, and addressing technical information pursuant to NEPA regulations and in identifying the topics and issues to be evaluated and considered throughout the planning process. All scoping comments were considered to be important and useful guidance in the planning process.

AGENCY CONSULTATION AND COORDINATION

Consultation

The following agencies have been consulted in accordance with applicable laws and regulations (i.e., Section 7 of the Endangered Species Act [16 U.S.C 1531 et seq.] and Section 106 of the National Historic Preservation Act per 36 CFR Part 800).

- Advisory Council on Historic Preservation
- State Historic Preservation Officer – Colorado Office of Archaeology and Historic Preservation
- USFWS

Meetings

An agency scoping/alternatives development meeting was hosted by NPS on August 20–23, 2012, representatives from the following agencies were present for the meeting:

- BLM
- CPW
- NPS
- USFS
- USFWS
- USGS

A follow on Multi-Agency Meeting on Preliminary Draft Alternatives was hosted by NPS on August 28, 2014 and included representatives from the following:

- CPW
- NPS
- TNC
- USFS

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- USFWS
- Zapata Partners

Over the course of the planning process numerous meetings have occurred between the NPS, CPW, and USFWS including a presentation to the Colorado Wildlife Commission on August 7, 2014 and November 17, 2017. Additionally, the National Park Service presented a briefing to the Colorado Department of Agriculture on August 6, 2014.

Status briefings have also been presented to the following organizations:

- Wet Mountain Valley HPP
- Mount Blanca HPP
- San Luis Valley HPP
- Sangre de Cristo HPP
- Saguache County Board of Commissioners
- Gunnison Sage Grouse Working Group
- Rio Grande Water Conservation District

Cooperating Agencies

Colorado Parks and Wildlife. CPW has jurisdiction /special expertise for elk management on non-park lands; identified as cooperator during agency scoping/alternatives development. The Memorandum of Understanding (MOU) was initially drafted in 2012 and ultimately executed per Department of Interior NEPA regulations on August 17, 2015.

U.S. Fish and Wildlife Service. USFWS has jurisdiction on the Baca NWR adjacent to the park and was identified as cooperator during agency scoping/alternatives development. The MOU was initially drafted in 2012 and was accepted on May 11, 2017.

TRIBAL CONSULTATION

Annual meetings occur for the San Luis Valley Native American Graves Protection and Repatriation Act (NAGPRA) Working Group. Status report briefings were presented to the group on October 22–23, 2014 and October 6, 2016. Representatives from the following traditionally associated tribes were present for these working group meetings:

- Ute Mountain Tribe of the Ute Mountain Reservation
- Southern Ute Indian Tribe of the Southern Ute Reservation
- Jicarilla Apache Nation
- Navajo Nation, Arizona, New Mexico & Utah
- Pueblo of Zuni

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Additionally, copies of the public scoping newsletter and preliminary draft alternatives newsletter were distributed to the following tribes:

- Arapaho Tribe of the Wind River Reservation, Wyoming
- Cheyenne and Arapaho Tribes, Oklahoma
- Comanche Nation, Oklahoma
- Jicarilla Apache Nation, New Mexico
- Pueblo of Santo Domingo
- Kewa Pueblo, New Mexico
- Kiowa Indian Tribe of Oklahoma
- Navajo Nation, Arizona, New Mexico & Utah
- Northern Cheyenne Tribe of the Northern Cheyenne Indian Reservation, Montana
- Ohkay Owingeh, New Mexico
- Pueblo of Acoma, New Mexico
- Pueblo of Cochiti, New Mexico
- Pueblo of Isleta, New Mexico
- Pueblo of Jemez, New Mexico
- Pueblo of Laguna, New Mexico
- Pueblo of Picuris, New Mexico
- Pueblo of Pojoaque, New Mexico
- Pueblo of San Ildefonso, New Mexico
- Pueblo of Sandia, New Mexico
- Pueblo of Santa Ana, New Mexico
- Pueblo of Santa Clara, New Mexico
- Pueblo of Taos, New Mexico
- Pueblo of Zia, New Mexico
- San Juan Southern Paiute Tribe of Arizona
- Southern Ute Indian Tribe of the Southern Ute Reservation, Colorado
- Ute Indian Tribe of the Uintah & Ouray Reservation, Utah
- Ute Mountain Tribe of the Ute Mountain Reservation, Colorado, New Mexico & Utah
- White Mesa Ute
- Zuni Tribe of the Zuni Reservation, New Mexico

SCIENCE TEAM MEMBERS

Table 9. Science team members

Name	Organization	Name	Organization
Melissa Stedeford	NPS EQD	Ron Rivale	CPW
Art Hutchinson	GRSA	Ron Garcia	USFWS
Phyllis Pineda	GRSA	Pat Gonzales	USFWS
Cay Ogden	NPS Intermountain Region	Randy Ghormley	USFS/BLM
Stephanie Burkhart	NPS Intermountain Region	Kate Schoenecker	USGS
Mark Sturm	NPS Intermountain Region	Linda Zeigenfuss	USGS
Mike Britten	NPS Rocky Mountain	Chris Pague	TNC
Billy Schweiger	NPS Rocky Mountain	Paul Robertson	TNC
Rick Kahn	NPS Biological Resources	Cindy Villa	Natural Resources Conservation
Tom Flanagan	NPS EQD	Nicole Bauman	Weston Solutions, Inc.
Brad Weinmeister	CPW	Ron Beane	ERO Resources
Dave McCammon	CPW	Bill Mangle	ERO Resources
Rick Basagoitia	CPW		

LIST OF PREPARERS AND CONTRIBUTORS

Table 10. Preparers and contributors

Name	Experience/Expertise/Discipline
Lisa Carrico	33 years of National Park Service experience, 11 of which as Superintendent, in two different parks, with responsibility for management of park operations, including resource management programs
Fred Bunch	Over 26 years of experience as Chief of Resource Management at Great Sand Dunes National Park and Preserve
Dewane Mosher	5 years of natural resource management experience, including 1 year with the National Park Service
Rick Kahn	40 years of professional wildlife experience, including 6 years with the National Park Service
Mike Britten	29 years of experience with the National Park Service in resource management and research including long-term ecological monitoring of wildlife and vegetation

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Name	Experience/Expertise/Discipline
E. William Schweiger	26 years of experience with quantitative ecological research with a focus on wetland and aquatic resource management application, including 13 years with the National Park Service
Dan Niosi	17 years of planning and NEPA compliance experience with a focus on natural resources management, including 7 years with the National Park Service
Ron Beane	36 years of professional wildlife experience, including 29 years of NEPA compliance
Lia Jenkins	6 years of environmental planning and NEPA compliance experience as a natural resource specialist
Sean Larmore	22 years providing cultural resource management
David Hesker	27 years providing graphic design and GIS services for planning and NEPA-related projects, including 10 years working on National Park Service projects
Bill Mangle	18 years of environmental planning and NEPA compliance experience, including 8 years working on National Park Service projects
Tana Jones	19 years of environmental planning and NEPA compliance experience as a natural resource/water resource/biological resource specialist, including 8 years working on National Park Service projects

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Acronyms and Abbreviations



Acronyms and Abbreviations

BLM	Bureau of Land Management
CFR	Code of Federal Regulations
CNHP	Colorado Natural Heritage Program
CPW	Colorado Parks and Wildlife
CWD	Chronic Wasting Disease
DAU	Data Analysis Unit
dBA	A-weighted decibels
DOI	Department of Interior
ECA	Ecologically Critical Areas
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
GIS	Geographic Information System
GMP	General Management Plan
GMU	Game Management Unit
GRSA	Great Sand Dunes National Park and Preserve
ITBC	InterTribal Buffalo Council
IUCN	International Union for Conservation of Nature
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NPS	National Park Service
NRHP	National Register of Historic Places
NWR	National Wildlife Refuge
OAHP	Office of Archaeology and Historic Preservation
ROMN	Rocky Mountain Inventory & Monitoring Network
SHPO	State Historic Preservation Office
TNC	The Nature Conservancy
UUI	Ungulate Use Index
UMP	Ungulate Management Plan
USFS	U.S. Department of Agriculture, Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WEI	wetland ecological integrity

Acronyms and Abbreviations

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Action alternative: An alternative that proposes a different management action or actions to address the purpose, need, and objectives of the plan; one that proposes changes to the current management. Alternatives 2, 3, and 4 are the action alternatives in this planning process. See also: “No-action alternative.”

Adaptive management: The rigorous application of management, research, and monitoring to gain information and experience necessary to assess and modify management activities. A process that uses feedback from research and the periodic evaluation of management actions and the conditions they produce to either reinforce the viability of objectives, strategies, and actions prescribed in a plan or to modify strategies and actions in order to more effectively accomplish management objectives.

Affected environment: A description of the existing environment that may be affected by the proposed action (40 CFR 1502.15).

Biodiversity: The diversity of plant and animal species in an environment.

Browsing: When used in reference to ungulates, describes the eating of shoots or twigs of shrubs and trees.

Brucellosis: A highly contagious bacterial disease of domestic and wild animals that is most readily transmitted through exposure to an aborted fetus or other birth materials and fluids, and causes stillbirths, abortions, infertility, and decreased milk production. Also known as Bangs disease, undulant fever, and contagious abortion.

Carrying capacity: Sometimes called “biological carrying capacity,” this is the maximum number of animals of a species that can live in a given environment. Carrying capacity is not a static number but an ever-changing target that will vary, short-term, with weather and range conditions, and long-term with gradual alterations in habitat and vegetation communities.

Chronic Wasting Disease (CWD): A slowly progressive, infectious, self-propagating neurological disease of captive and free-ranging deer, elk, and moose. CWD belongs to the transmissible spongiform encephalopathy group of diseases and is characterized by accumulations of abnormal prion proteins in neural and lymphoid tissue.

Contractor: For the purposes of this plan, a contractor is a fully insured business entity, nonprofit group, or other entity engaged in wildlife management activities that include the direct reduction with firearms. The contractor would possess all necessary permits.

Compaction: The compression of soil layers reducing the ability of plants to survive, reducing water infiltration capacity, and increasing water runoff.

Conservation herd: designation assigned to bison herds managed by federal or state/provincial governments or non-governmental organizations whose mission is nature conservation.

Critical habitat: As defined in the Endangered Species Act (1973), pertains to: “(i) the specific areas in the geographical area occupied by the species, at the time it is listed in accordance with the provisions of section 4 of this Act, on which are found those

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physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 4 of this Act, upon a determination by the Secretary (of the U.S. Department of the Interior) that such areas are essential for the conservation of the species.

Cumulative impacts: Those impacts on the environment that result from the incremental effect of the action when added to the past, present, and reasonable foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

Demographic: Referring to the intrinsic factors that contribute to a population's growth or decline: birth, death, immigration, and emigration. The sex ratio of the breeding population and the age structure (the proportion of the population found in each age class) are also considered demographic factors because they contribute to birth and death rates.

Ecological integrity: The capacity to support and maintain a balanced, integrated, and adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of natural habitats of the region (Karr 1991).

Ecologically Critical Areas (ECAs): Defined as "special ecosystems that serve unique functions and are small in area or are unusually fragile relative to others."

Ecosystem: An ecological system; the interaction of living organisms and the nonliving environment producing an exchange of materials and energy between the living and nonliving.

Endangered species: Any species that is in danger of extinction throughout all or a significant portion of its range [16 USC 1532(6)].

Endangered Species Act of 1973: An Act to provide for the conservation of endangered and threatened species of fish, wildlife, and plants, and for other purposes [16 U.S.C. § 1531 et seq.]

Endemic: Native to or confined to a particular region.

Environment: The sum total of all biological, chemical, and physical factors to which organisms are exposed; the surroundings of a plant or animal.

Environmental consequences: Environmental effects of project alternatives, including the proposed action, any adverse environmental effects which cannot be avoided, the relationship between short term uses of the human environment, and any irreversible or irretrievable commitments of resources which would be involved if the proposal should be implemented (40 CFR 1502.16).

Environmental impact statement (EIS): A detailed written statement required by Section 102(2)(C) of the National Environmental Policy Act, analyzing the environmental impacts of a proposed action, adverse effects of the project that cannot be avoided, alternative courses of action, short term uses of the environment versus the maintenance and

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enhancement of long term productivity, and any irreversible and irretrievable commitment of resources (40 CFR 1508.11).

Ethnographic resource: Any site, structure, object, landscape, or natural resource feature assigned traditional legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it.

Exclosure: An area enclosed by a barrier, such as a fence, to protect vegetation and prevent browsing by animals.

Extirpated species: A species that is no longer present in an area where it once lived.

Extirpation: Disappearance from a specified geographic area.

Fertility control: A method or methods used to limit the numbers of animals in a population by decreasing the reproductive success of the animals, such as contraception or sterilization.

Free-ranging bison: Bison not routinely handled by humans that can move without restrictions in specific geographic areas.

Habitat: The environment in which a plant or animal lives (includes vegetation, soil, water, and other factors).

Herbaceous: A plant with no persistent woody stem above ground; characteristics of that of an herb.

Home range: The geographic area in which an animal normally lives.

Hydrologic: Pertaining to the occurrence, circulation, distribution, and properties of the water.

Invasive species: Any introduced plant, animal or protist species that is not native to the area and may be considered a nuisance; also called non-native or alien species; a species that did not evolve in concert with the species native to an ecosystem, and occupies or could occupy park lands directly or indirectly as the result of deliberate or accidental human activities. Sometimes called “non-native,” “alien,” or “invasive.”

Migratory Bird Treaty Act of 1918: First enacted in 1916 to implement the convention for the protection of migratory birds between the United States and Great Britain (acting on behalf of Canada). The statute makes it unlawful without a waiver to pursue, hunt, take, capture, kill, or sell birds listed therein as migratory birds. The statute does not discriminate between live or dead birds and also grants full protection to any bird parts including feathers, eggs, and nests. Over 800 species are currently on the list. [16 U.S.C. §§ 703–712]

Monitoring: A process of collecting information to evaluate if an objective and/or anticipated or assumed results of a management plan are being realized (effectiveness monitoring) or if implementation is proceeding as planned (implementation monitoring).

National Environmental Policy Act of 1969 (NEPA): A law that requires all Federal agencies to examine the environmental impacts of their actions, incorporate environmental information, and utilize public participation in the planning and implementation of all actions. Federal agencies must integrate NEPA with other planning requirements and prepare appropriate NEPA documents to facilitate better environmental decision making.

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NEPA requires Federal agencies to review and comment on Federal agency environmental plans/documents when the agency has jurisdiction by law or special expertise with respect to any environmental impacts involved (42 U.S.C. 4321-4327) (40 CFR 1500-1508).

No-action alternative: The alternative in which baseline conditions and trends are projected into the future without any substantive changes in management (40 CFR 1502.14(d)). Alternative 1 is the no-action alternative in this planning process.

Palatability: The property of being acceptable to the taste or sufficiently agreeable in flavor to be eaten.

Policies: A definite course of action selected by a government agency to guide and determine present and future decisions.

Population (or species population): A group of individual plants or animals that have common characteristics and interbreed among themselves and not with other similar groups.

Range: The geographical extent of a species or subspecies.

Record of Decision: A concise public record of decision prepared by a federal agency, pursuant to NEPA, that contains a statement of the decision, identification of all alternatives, a statement as to whether all practical means to avoid or minimize environmental harm from the alternative selected have been adopted (and if not, why they were not), and a summary of monitoring and enforcement where applicable for any mitigation (40 CFR 1505.2).

Regulation: A rule or order issued by a government agency, having the force of law under power granted through legislation.

Reproductive control: A method or methods used to limit the numbers of animals in a population by decreasing the reproductive success of the animals, such as contraception or sterilization.

Riparian: Pertaining to, situated or dwelling on the bank of a river or other body of water.

Riparian areas: Zones of transition from aquatic to terrestrial ecosystems, dependent on surface and or subsurface water for existence, and which manifest the influence of that water.

Sapling: A young tree, generally not over 4 inches in diameter at breast height.

Scoping: An early and open process for determining the extent and variety of issues to be addressed and for identifying the significant issues related to a proposed action (40 CFR 1501.7).

Sensitive species: Those plant and animal species identified by a regional forester for which population viability is a concern.

Seral: A phase in the sequential development of a climax community. The USFS defines seral stage as “the sequence of a plant community’s successional stages to potential natural vegetation.”

Sex ratio: The proportion of males to females (or vice versa), in a population. A sex ratio of 50:50 would mean an equal number of does and bucks in a deer population.

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Sharpshooting: The authorized shooting of animals by specially trained professionals using appropriate weapons for means of effective and efficient lethal control.

Species diversity: The variety of different species present in a given area; species diversity takes into account both species richness and the relative abundance of species.

Springs: A class of surface water characterized by well-defined flow paths that lend them to water capture and further development.

Threatened and endangered species: Any species of fish, wildlife, and plants that is listed as threatened or endangered by the U.S. Fish and Wildlife Service.

Threatened species: Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range [16U.S.C. 1532(20)].

Trained volunteers: For the purposes of this plan, a trained volunteer would include individuals identified through an NPS-developed system which have a demonstrated level of firearm proficiency established by the park. Other skilled volunteers (e.g., veterinarians who volunteer to assist with CWD testing) would need to demonstrate appropriate proficiency depending on their proposed involvement. Those skilled volunteers that qualify for participation would become part of a pool of available personnel that may supplement elk management teams. In addition, all skilled volunteers would be directly supervised in the field by NPS personnel during any elk management actions.

Translocation: For this plan, defined as roundup and relocation of animals to willing recipients (see definition of “Willing Recipients”) outside the park

Turbidity: Visible undissolved solid material suspended in water.

Ungulate: hoofed, typically herbivorous, animal; includes horses, cows, deer, elk, and bison.

Vaccine: A suspension of killed or attenuated microorganisms that, when introduced into the body, stimulates an immune response against that microorganism.

Watershed: The region or area drained by a river, stream, etc.

Wetland: Areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Wildlife management: The science of protecting, restoring, or manipulating populations of wild animals in order to meet any of several objectives ranging from intense human use to preservation of complete natural processes.

Willing recipients: For this plan, willing recipients are defined as tribes, non-profit groups, or other agencies (state and federal) interested in receiving elk from translocation.

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